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USAFOEHL REPORT

89-010EQ0178BEF



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# COMPLIANCE TESTING OF HOT WATER AND STEAM BOILERS, SHAW AFB SC

JAMES A. GARRISON, Major, USAF, BSC

February 1989

Final Report

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USAF Occupational and Environmental Health Laboratory  
Human Systems Division (AFSC)  
Brooks Air Force Base, Texas 78235-5501

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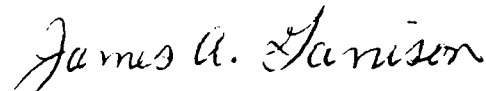
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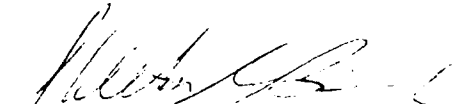
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This report has been reviewed and is approved for publication.



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Chief, Air Quality Function



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Chief, Consultant Services Division

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| <p>At the request of HQ TAC/DEEV, personnel of the USAFOEHL Air Quality Function conducted source testing of eighteen small hot water and steam boilers to determine stack gas moisture content and velocity. The data obtained during the survey was necessary for boiler operating permit application.</p> <p>Final results were determined on-site and provided to 363 CES/DEEV personnel so that permit application could be initiated immediately.</p> |       |   |  |  |                           |
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## I. INTRODUCTION

On 8-24 Aug 1988, a stationary source emission survey was conducted at Shaw AFB by personnel of the Air Quality Function, USAF Occupational and Environmental Health Laboratory (USAFOEHL) to determine stack exhaust gas moisture content and velocity for 18 small oil and gas fired boilers. This survey was requested by HQ TAC/DEEV to assist Shaw AFB in obtaining the necessary boiler operating permits required by the State of South Carolina. Personnel involved with on-site testing are listed in Appendix A.

## II. DISCUSSION

### A. Background

Shaw AFB received a consent order from the South Carolina Department of Health and Environmental Control, Bureau of Air Quality Control for not having obtained operating permits for 18 boilers located on the base. Permit applications were then filed, but were returned due to lack of data on moisture content and velocity. USAFOEHL was requested to provide this information so that the base could obtain the necessary operating permits and demonstrate and maintain compliance with all provisions under the South Carolina Department of Health and Environmental Control; Regulation 61-62 - Air Pollution Control Regulations and Standards.

### B. Site Description

The 18 boilers tested ranged in size from  $1.05 \times 10^6$  to  $8.4 \times 10^6$  BTU/hr input and were located in 13 separate buildings. The primary purpose of the boilers is to provide steam heat or hot water at the particular location. The location and operating parameters of each boiler are found on the permit applications provided in Appendix B. Typical boilers tested are shown in Figures 1 and 2. Typical stacks and test sites are pictured in Figures 3-8.

### C. Applicable Standards

Permit procedures are defined under Regulation No. 62.1, Air Pollution Control, Section II, Permit Requirements. Emission Standards are defined under Regulation No. 62.5, Air Pollution Control Standards, Standard No.1, Emissions From Fuel Burning Operations. These regulations are provided in Appendix C.

### D. Sampling Methods and Procedures

All stack tests were conducted in accordance with the procedures and analysis methods specified in Chapter 40, Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A, Methods 1-4. Therefore, test methods, equipment, sample train preparations, sampling and recovery, calibration requirements and quality assurance were done in accordance with the methods and procedures outlined in 40 CFR 60, Appendix A.

Sampling ports were installed in the exhaust stack or ducting and traverse points determined for each site in accordance with Method 1.

Exhaust gas moisture content and velocity were determined simultaneously using the sampling train pictured in Figure 9. The train consisted of a button-hook probe nozzle, heated glass probe, heated glass filter, impingers and pumping and metering device. Flue gas velocity pressure was measured at the nozzle tip using a Type-S pitot tube connected to a 10 inch inclined-venturi manometer. Where stack/duct diameters were less than 12 inches, a detached pitot tube was used so as not to significantly block the duct cross section. A 1-inch inclined manometer was used where gas velocity pressure was less than 0.05 inches of water. Type K thermocouples were used to measure flue gas as well as sampling train temperatures. The probe was heated to minimize moisture condensation. The heated filter was used to remove particulate materials. The impinger train (first, third and fourth impingers; modified Greenburg-Smith type; second impinger; standard Greenburg-Smith design) was used as a condenser to collect stack gas moisture. The pumping and metering system was used to control and monitor the sample gas flow rate. Equipment calibration data is presented in Appendix P.

The sampling time and sample rate for each test run was selected to provide the minimum 21 standard cu ft sample volume and 0.75 cu ft per minute sample rate required by Method 4.

During initial sample runs, flue gas samples for orsat analysis (measures oxygen and carbon dioxide for stack gas molecular weight determination) were taken. Molecular weights determined from these samples averaged about 29.6. This value was assumed for all subsequent calculations. Orsat sampling and analysis equipment are shown in Figures 10 and 11.

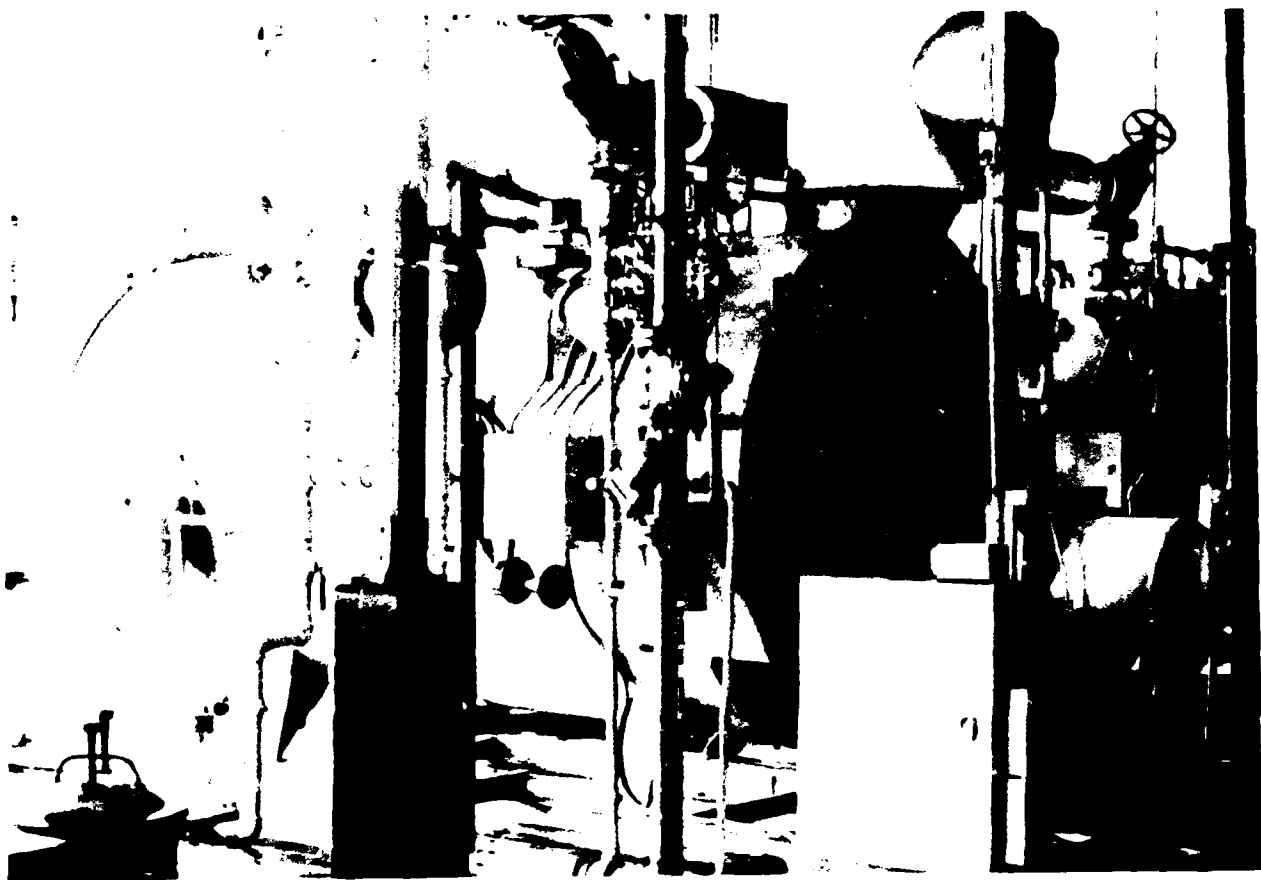
Moisture and velocity calculations were done using "Source Test Calculation and Check Programs for Hewlett-Packard 41 Calculators" (EPA-340/ 1-85-018) developed by the EPA Office of Air Quality Planning and Standards, Research Triangle Park NC. This is our standard method for calculating emissions data. Moisture and velocity calculations are found in Appendix Q.

### **III. CONCLUSIONS AND RECOMMENDATIONS**

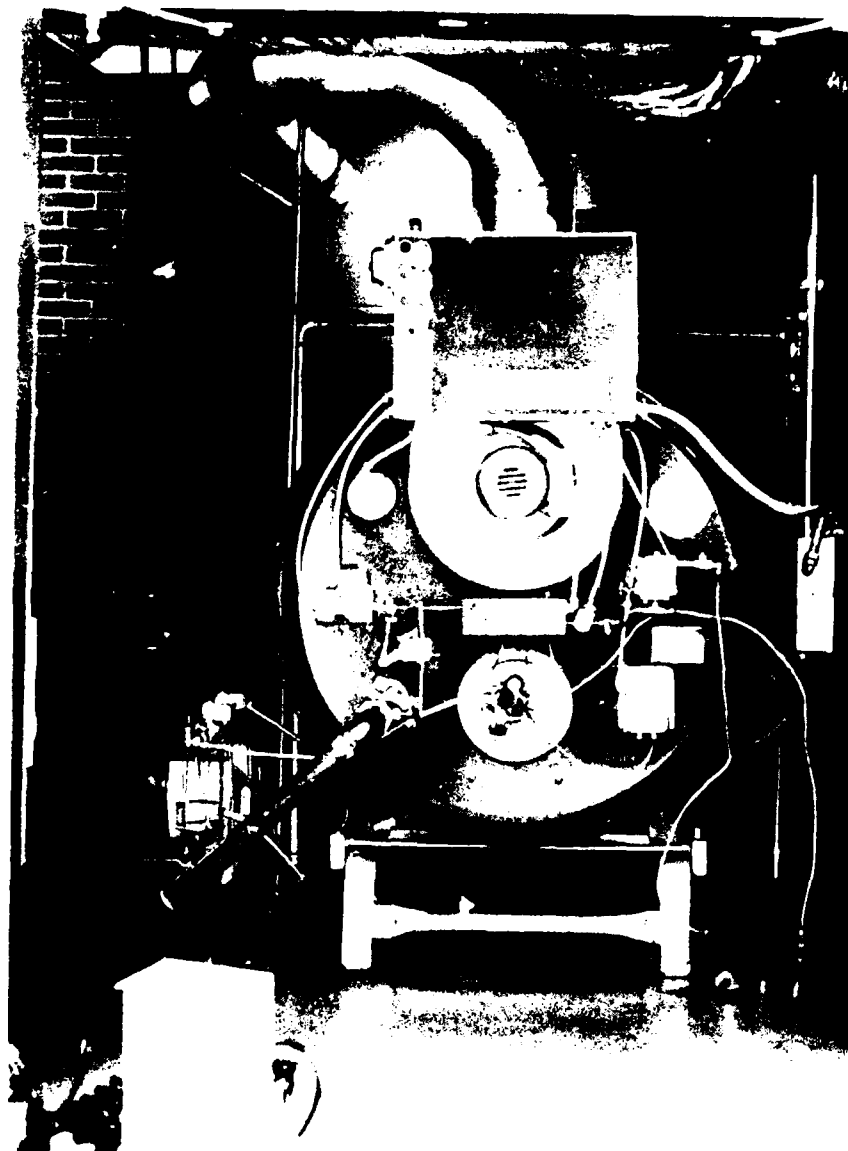
Table 1 provides the survey results for all boilers tested. In some cases, modifications to the stack were made to accommodate the sampling ports. Duct diameters shown were obtained where the ports were installed. Where the inside stack or duct diameter measured during testing was different from that on the permit application, the velocity was corrected to the diameter listed on the application. These results were determined on site and provided to 363 CES/DEEV personnel so that permit application could be initiated immediately.

The USAFOEHL will continue to support Shaw AFB as necessary in this project with consultative and testing assistance.





**Figure 1. Heat Plant Steam Boiler**



**Figure 2. Bullding 1102, Hot Water Boller**



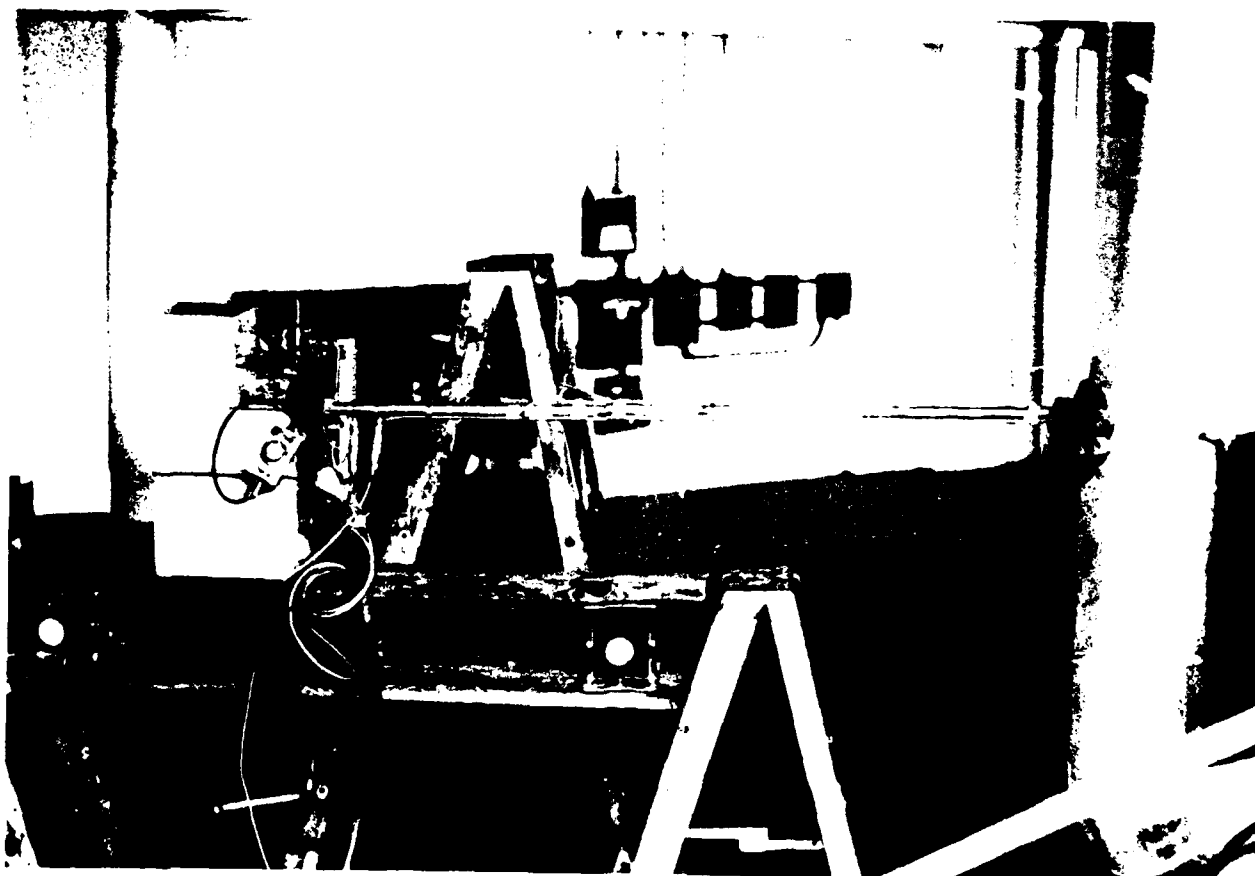
**Figure 3. Building 611, Test Site**



Figure 4. Building 922, Test Site



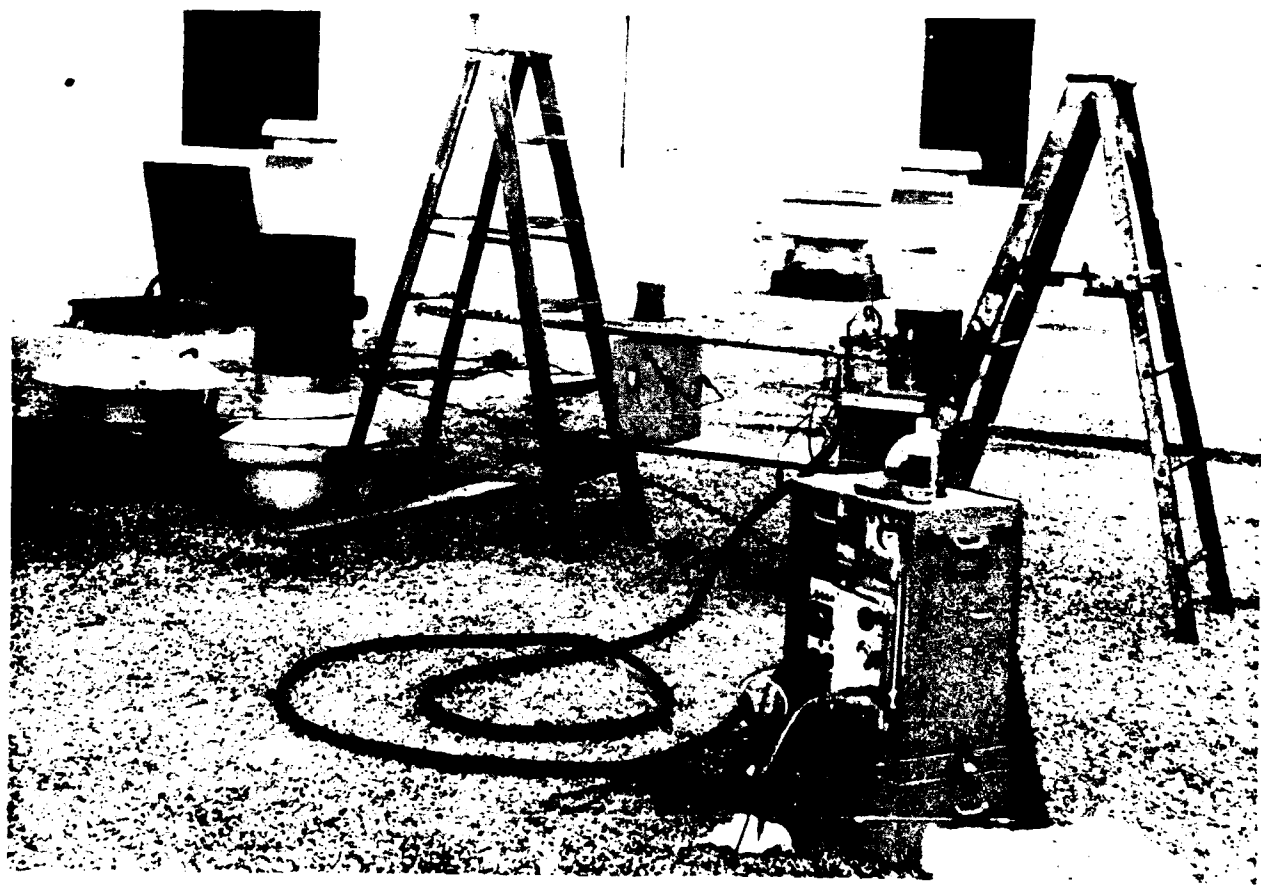
**Figure 5. Building 1046, Test Site**



**Figure 6. Building 1130, Test Site**



**Figure 7. Building 1200, Test Site**



**Figure 8. Building 1206, Test Site**



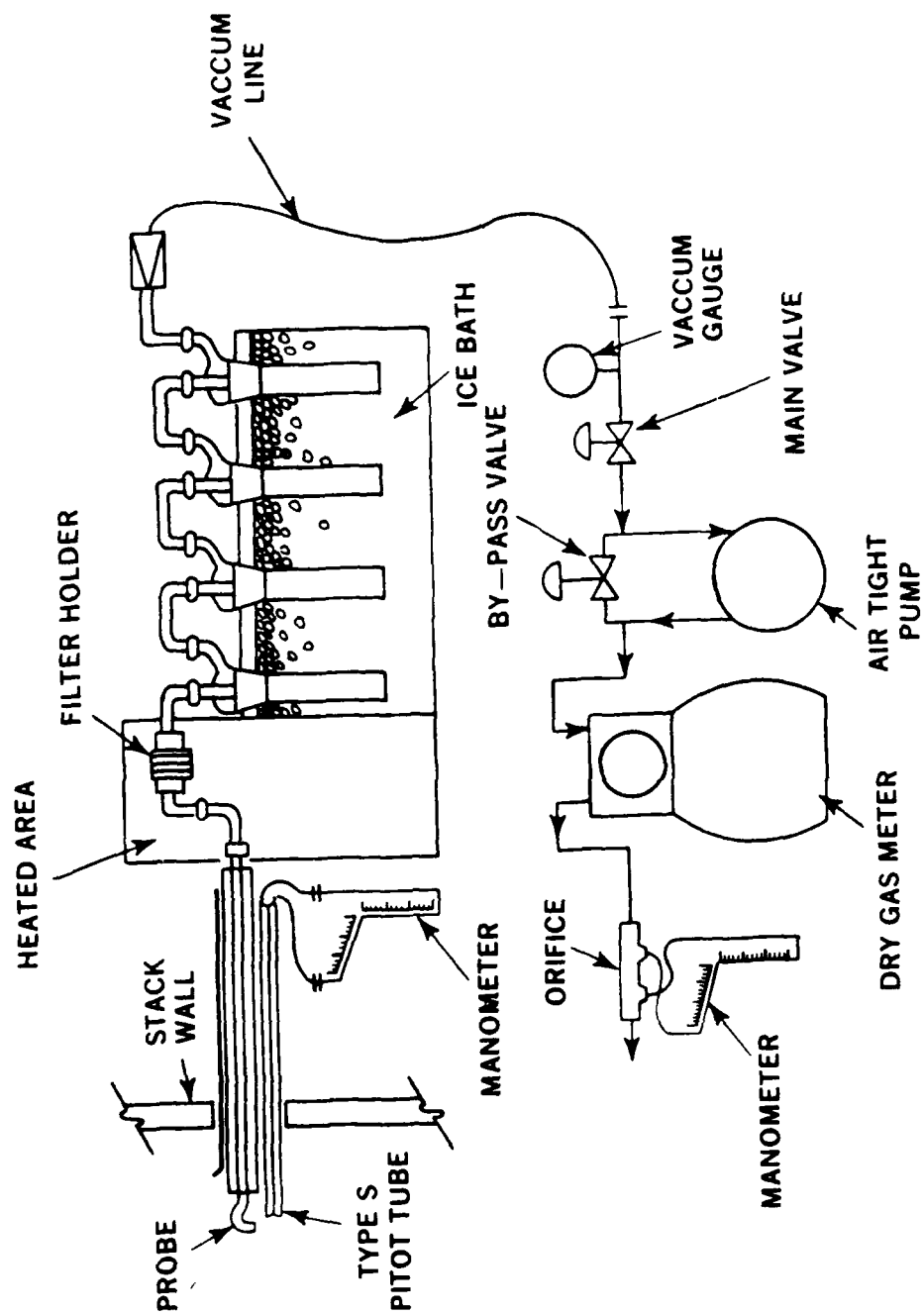


Figure 9. Moisture Sampling Train

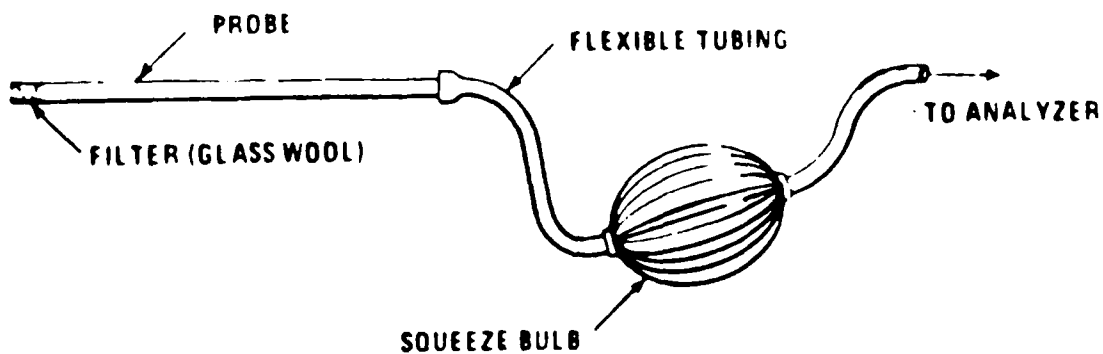


Figure 10. ORSAT Sampling Train

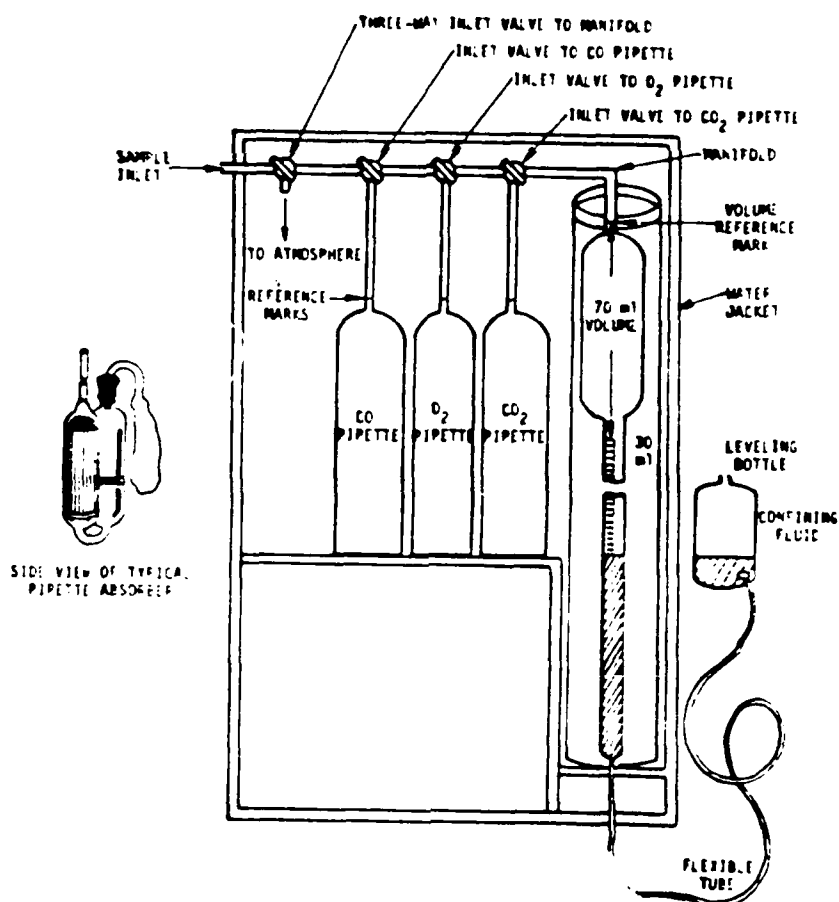


Figure 11. ORSAT Apparatus

TABLE 1

## % MOISTURE AND VELOCITY TEST RESULTS

| BLDG NO. | TYPE*<br>BOILER | % MOISTURE BY VOLUME | DUCT**<br>DIAMETER<br>(ft) | VELOCITY***<br>(fps) |
|----------|-----------------|----------------------|----------------------------|----------------------|
| 403      | #2, ST          | 15.26                | 1.02(1.00)                 | 30.0                 |
|          | #3, ST          | 14.73                | 1.02(1.00)                 | 27.0                 |
|          | #5, ST          | 15.54                | 1.31(1.66)                 | 26.0(16.0)           |
| 611      | ST              | 11.28                | 1.15(0.66)                 | 26.0(77.0)           |
| 922      | HW              | 7.58                 | 0.66(0.66)                 | 3.0                  |
|          | ST              | 19.94                | 0.81(0.66)                 | 11.0(17.0)           |
| 1046     | HW              | 12.55                | 1.25(0.66)                 | 15.0(55.0)           |
| 1102     | HW              | 9.90                 | 0.81(0.66)                 | 15.0(23.0)           |
| 1130     | ST              | 9.02                 | 0.83(0.66)                 | 28.0(45.0)           |
| 1200     | #1, ST          | 9.01                 | 0.78(1.0)                  | 22.0(14.0)           |
|          | #2, ST          | 12.42                | 0.78(1.0)                  | 11.0(7.0)            |
|          | #3, ST          | 10.88                | 0.78(1.0)                  | 20.0(13.0)           |
| 1206     | ST              | 10.54                | 1.16(0.66)                 | 8.0(24.0)            |
| 1402     | HW              | 9.50                 | 0.90(0.66)                 | 11.0(20.0)           |
| 1422     | HW              | 12.27                | 1.46(0.66)                 | 9.0(45.0)            |
| 1604     | HW              | 10.56                | 0.63(0.66)                 | 22.0(20.)            |
| 1614     | #1, ST          | 10.65                | 1.33(1.0)                  | 12.0(21.0)           |
|          | #2, ST          | 9.41                 | 1.33(1.0)                  | 12.0(21.0)           |

\* ST = Steam boiler  
HW = Hot water boiler

\*\* Duct diameter measured during testing. ( ) indicates duct diameter listed on permit.

\*\*\* Velocity for duct diameter measured during testing. ( ) indicates stack velocity corrected to stack diameter listed on permit.

## REFERENCES

1. "Standards of Performance for New Stationary Sources," Title 40, Part 60, Code of Federal Regulations, July 1, 1987.
2. Quality Assurance Handbook for Air Pollution Measurement Systems - Volume III, Stationary Source Specific Methods, U.S. Environmental Protection Agency, EPA-600/4-77-027-b, Research Triangle Park, North Carolina, December 1984.
3. Source Test Calculation and Check Programs for Hewlett-Packard 41 Calculators. U.S. Environmental Protection Agency, EPA-340/1-85-018, Research Triangle Park, North Carolina, May 1987.

**APPENDIX A**  
**Personnel Information**

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## Personnel Information

### 1. USAFOEHL Test Team

Maj James Garrison, Chief, Air Quality Function  
Capt Paul T. Scott, Consultant, Air Resources Meteorologist  
SSgt Shelley Schelin, Bioenvironmental Engineering Technician  
SSgt Pietro LaPorta, Bioenvironmental Engineering Technician

USAFOEHL/ECQ  
Brooks AFB TX 78235-5501

Phone: AUTOVON 240-2891  
Commercial (512) 536-2891

### 2. Shaw AFB on-site representatives

Capt Michael Rusden, 363 Medical Group (TAC)/SGPB  
SSgt Edward Meltz, 363 Medical Group (TAC)/SGPB  
SSgt Deral Freysinger, 363 Medical Group (TAC)/SGPB  
Karl Chandler, 363 CES/DEEV  
Penny Spell, 363 CES/DEEV  
Joe Bartlett, 363 CES/DEMMH  
TSgt Paul Trageser, 363 CES/DEMMH

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**APPENDIX B**  
**Permit Applications**

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U.S. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

BUREAU USE  
Permit No.:  
ID. No.:  
Date:  
Reviewed By:

PART IIA

1. Company Name: SHAW AFB Date: 20 Apr 88  
Type of Fuel Burning Operation: Steam Boiler Heating BLDG 403  
Unit Description: Heat Plant Boilers #2 & #3

2. Make: Superior Aztec Model: 5-5-402  
Capacity: Rated Input 2.76 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel        | BTU                      | % Sulfur  | % Ash     | Consumption              |
|-------------|--------------------------|-----------|-----------|--------------------------|
| Impurity    | Content                  | by weight | by weight | @ rated capacity         |
| Natural Gas | 1035 BTU/Ft <sup>3</sup> | NIL       | NIL       | 2566 Ft <sup>3</sup> /HR |
| Oil         | 140,000 BTU/Gal          | 0.17      | NIL       | 20 GAL/HR                |
|             |                          |           |           |                          |
|             |                          |           |           |                          |

4. Fuel type (solid fuels only): \_\_\_\_\_ Pulverized \_\_\_\_\_ Traveling Grate  
\_\_\_\_\_ Fluidized Bed \_\_\_\_\_ Other (specify \_\_\_\_\_)  
If other, give description of fuel used, give % reinjection: \_\_\_\_\_

5. Air Pollution Control Device Description: None

6. Stack Data:  
Height Above Ground 35 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter 1.0 ft Temperature \_\_\_\_\_ °F  
Exit Moisture \_\_\_\_\_ Location (UTM or Lat-Long) BLDG 402

7. Emissions Data (rated capacity (lb/hr)):

|                    | Before Control | After Control | Method of Estimating Emissions |
|--------------------|----------------|---------------|--------------------------------|
| Particulate Matter | <u>0.001</u>   | <u>0.01</u>   | <u>AP 42 Dec 84</u>            |
| CO                 | <u>0.002</u>   | <u>0.09</u>   | <u>AP 42 Dec 84</u>            |
| SO <sub>2</sub>    | <u>0.05</u>    | <u>0.1</u>    | <u>AP 42 Dec 84</u>            |
| NO <sub>x</sub>    | <u>0.05</u>    | <u>0.1</u>    | <u>AP 42 Dec 84</u>            |
| Other pollutants:  |                |               |                                |
|                    |                |               |                                |
|                    |                |               |                                |

8. Are there any hazardous materials or hazardous waste management units to be burned in this unit? (specify): \_\_\_\_\_

9. Fuel type (solid fuels only): \_\_\_\_\_ Pulverized \_\_\_\_\_ Traveling Grate  
\_\_\_\_\_ Fluidized Bed \_\_\_\_\_ Other (specify \_\_\_\_\_)

10. Are there any hazardous materials or hazardous waste management units to be burned in this unit? (specify): N/A

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

BUREAU USE  
Permit No.:  
ID. No.:  
Date:  
Reviewed By:

PART IIA

1. Company Name: SHAW AFB Date: 20 Apr 88  
Type of Fuel Burning Operation: Steam Boiler Heating BLDG 403  
Unit Designation: Heat Plant Boiler #5

2. Make: Kewanee Model: H-35-200-G06  
Capacity: Rate: Input 8.369 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content                    | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity  |
|---------------------|--------------------------------|--------------------|-----------------|-------------------------------|
| <u>Natural Gas</u>  | <u>1035 BTU/ft<sup>3</sup></u> | <u>NIL</u>         | <u>NIL</u>      | <u>2086 ft<sup>3</sup>/hr</u> |
| <u>72 Oil</u>       | <u>140,000 BTU/gal</u>         | <u>0.17</u>        | <u>NIL</u>      | <u>50 gal/hr</u>              |
|                     |                                |                    |                 |                               |
|                     |                                |                    |                 |                               |

4. Burner Type (solid fuels only): \_\_\_\_\_ Pulverized \_\_\_\_\_ Traveling Grate  
\_\_\_\_\_ Underfeed Stoker \_\_\_\_\_ Other (specify) \_\_\_\_\_  
If flyash reinjection is to be used, give % reinjection. \_\_\_\_\_

5. Air Pollution Control Device Description: None

6. Stack Data:

Height Above Ground 35 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter 1.66 ft Temperature \_\_\_\_\_ °F  
Est. Moisture \_\_\_\_\_ % Location (UTM or Lat/Long) Bldg 403

7. Emission Data at rated capacity (lb/hr):

| Pollutant          | Before Control Device | After Control Device | Method of Estimating Emissions |
|--------------------|-----------------------|----------------------|--------------------------------|
| Particulate Matter | <u>.024</u>           | <u>.12</u>           | <u>AP 42 Dec 84</u>            |
| CO                 | <u>.005</u>           | <u>1.47</u>          | <u>AP 42 Dec 84</u>            |
| SO <sub>2</sub>    | <u>.10</u>            | <u>.30</u>           | <u>AP 42 Dec 84</u>            |
| NO <sub>x</sub>    | <u>.30</u>            | <u>1.4</u>           | <u>AP 42 Dec 84</u>            |
| Other (specify):   |                       |                      |                                |
|                    |                       |                      |                                |

8. Are any materials subject to provisions of the S.C. Hazardous Waste Management Act or regulation to be burned in this unit? (specify): \_\_\_\_\_

9. How many hours per year: \_\_\_\_\_ hours/day \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year  
\_\_\_\_\_ Mar.-May \_\_\_\_\_ June-Aug. \_\_\_\_\_ Sept.-Nov. \_\_\_\_\_

10. How will waste material from process and control equipment be disposed of?  
\_\_\_\_\_

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

BUREAU USE  
Permit No.:  
ID. No.:  
Date:  
Reviewed By:

PART IIA

1. Company Name: SHAW AFB Date: 20 Apr 88  
Type of Fuel Burning Operation: Steam Boiler Heating  
Unit Designation: Bldg 611 Boiler

2. Make: Spencer Model: 4F-360-50-S  
Capacity: Rated Input 3.015 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content              | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity |
|---------------------|--------------------------|--------------------|-----------------|------------------------------|
| Natural Gas         | 1035 BTU/Ft <sup>3</sup> | NIL                | NIL             | 2913 Ft <sup>3</sup> /HR     |
| Oil                 | 140,000 BTU/Gal          | 0.1                | NIL             | 21.5 Gal/HR                  |
|                     |                          |                    |                 |                              |
|                     |                          |                    |                 |                              |

4. Burner Type (solid fuels only): \_\_\_\_\_ Pulverized \_\_\_\_\_ Traveling Grate  
\_\_\_\_\_ Underfeed Stoker \_\_\_\_\_ Other (specify) \_\_\_\_\_  
If flyash reinjection is to be used, give % reinjection. \_\_\_\_\_

5. Air Pollution Control Device Description: None

6. Stack Data:

Height Above Ground 25 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter 36 ft Temperature \_\_\_\_\_ °F  
Est. Moisture \_\_\_\_\_ % Location (UTM or Lat/Long) Bldg 611

7. Emission Rate at rated capacity (lb/hr):

|                    | Before Control Device | After Control Device | Method of Estimating Emissions |
|--------------------|-----------------------|----------------------|--------------------------------|
| Particulate Matter | 0.000                 | 0.043                | AP 42 Dec 24                   |
| SO <sub>2</sub>    | 0.000                 | 0.00                 | AP 42 Dec 31                   |
| CO                 | 0.00                  | 0.00                 | AP 42 DEC 04                   |
| H <sub>2</sub>     | 0.00                  | 0.00                 | AP 42 DEC 04                   |
| Other (specify):   |                       |                      |                                |
|                    |                       |                      |                                |
|                    |                       |                      |                                |

8. Are any materials subject to provisions of the S.C. Hazardous Waste Management Act or regulations to be burned in this unit? (specify): no

9. Normal operating schedule: \_\_\_\_\_ hours/day \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year  
\_\_\_\_\_ days/week \_\_\_\_\_ days/week \_\_\_\_\_ days/week \_\_\_\_\_ days/week \_\_\_\_\_ days/week

10. How will waste material from process and control equipment be disposed of?

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

PART IIA

SHREVE 028  
Permit No.:  
ID. No.:  
Date:  
Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88  
Type of Fuel Burning Operation: Hot Water Boiler  
Unit Designation: Bldg 922 H/W Boiler

2. Make: A.O. Smith Model: BT 80-916  
Capacity: Rated Input 1,7085 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content                    | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity  |
|---------------------|--------------------------------|--------------------|-----------------|-------------------------------|
| <u>Natural Gas</u>  | <u>1035 BTU/Ft<sup>3</sup></u> | <u>NIL</u>         | <u>-</u>        | <u>1631 Ft<sup>3</sup>/HR</u> |
|                     |                                |                    |                 |                               |
|                     |                                |                    |                 |                               |
|                     |                                |                    |                 |                               |

4. Burner Type (solid fuels only):    Pulverized    Traveling Grate  
   Underfeed Stoker    Other (specify) \_\_\_\_\_  
If flyash reinjection is to be used, give % reinjection. \_\_\_\_\_

5. Air Pollution Control Device Description: None

6. Stack Data:

Height Above Ground 25 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter .60 ft Temperature \_\_\_\_\_ °F  
Est. Moisture \_\_\_\_\_ % Location (UTM or Lat/Long) 1100 1411

7. Emission Rate at rated capacity (lb/hr):

| Pollutant          | Before Control Device | After Control Device | Method of Estimating Emissions |
|--------------------|-----------------------|----------------------|--------------------------------|
| Particulate Matter | <u>.005</u>           |                      | <u>12 CF Reg 62</u>            |
| SO <sub>2</sub>    | <u>.000*</u>          |                      | <u>12 CF Reg 62</u>            |
| CO                 | <u>.00</u>            |                      | <u>12 CF Reg 62</u>            |
| NO <sub>x</sub>    | <u>.00</u>            |                      | <u>12 CF Reg 62</u>            |
| Other (specify):   |                       |                      |                                |
|                    |                       |                      |                                |
|                    |                       |                      |                                |

8. Are any materials subject to provisions of the S.C. Hazardous Waste Management and Control Regulations to be burned in this unit? (specify): \_\_\_\_\_

9. How will the material from pre- and post-control equipment be disposed of? \_\_\_\_\_

10. How will the material from pre- and post-control equipment be disposed of? \_\_\_\_\_

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

CURRENT USE  
Permit No.:  
ID. No.:  
Date:  
Reviewed By:

PART III

1. Company Name: SHAW AFB Date: 20 Apr 88  
Type of Fuel Burning Operation: Steam Boiler Heating  
Unit Designation: Bldg 922 Boiler for Heat

2. Make: Crane Model: 615-N-51-2 NP  
Capacity: Rated Input 1.722 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content                    | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity  |
|---------------------|--------------------------------|--------------------|-----------------|-------------------------------|
| <u>Natural Gas</u>  | <u>1035 BTU/ft<sup>3</sup></u> | <u>N/A</u>         | <u>N/A</u>      | <u>1664 ft<sup>3</sup>/hr</u> |
| <u>#2 Oil</u>       | <u>140,000 BTU/gal</u>         | <u>N/A</u>         | <u>N/A</u>      | <u>12.3 gal/hr</u>            |
|                     |                                |                    |                 |                               |
|                     |                                |                    |                 |                               |

4. Burner Type (solid fuels only):    Pulverized    Traveling Grate  
   Underfeed Stoker    Other (specify) \_\_\_\_\_  
If flyash reinjection is to be used, give % reinjection. \_\_\_\_\_

5. Air Pollution Control Device Description: CDH

6. Stack Data:

Height Above Ground 25 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter .36 ft Temperature \_\_\_\_\_ °F  
Est. Moisture \_\_\_\_\_ % Location (UTM or Lat/Long) Bldg 922

7. Emission Rate at rated capacity (lb/hr):

| Pollutant          | Before Control Device | After Control Device | Method of Estimating Emissions |
|--------------------|-----------------------|----------------------|--------------------------------|
| Particulate Matter | <u>.005</u>           | <u>.005</u>          | <u>AP 42 Sec 84</u>            |
| SO <sub>2</sub>    | <u>.001</u>           | <u>.001</u>          | <u>AP 42 Sec 84</u>            |
| CO                 | <u>.133</u>           | <u>.133</u>          | <u>AP 42 Sec 84</u>            |
| VOC                | <u>.001</u>           | <u>.001</u>          | <u>AP 42 Sec 81</u>            |
| Other (specify):   |                       |                      |                                |
|                    |                       |                      |                                |
|                    |                       |                      |                                |

8. Are there materials subject to regulation under the S.C. Hazardous Waste Management Act which are to be burned in this unit? (specify): NO

9. How many times per week? \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year  
What is the operating season? \_\_\_\_\_ Jan.-Mar. \_\_\_\_\_ Sept.-Nov. \_\_\_\_\_

10. How will waste material from process and control equipment be disposed of? \_\_\_\_\_

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

PART IIA

UNCLASSIFIED

Permit No.:

ID. No.:

Date:

Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88  
Type of Fuel Burning Operation: Hot Water Boiler Heating  
Unit Designation: Bldg 1046 Boiler

2. Make: Peerless Model: 0-714-FD-W  
Capacity: Rated Input 1.2117 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>6</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content              | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity |
|---------------------|--------------------------|--------------------|-----------------|------------------------------|
| Natural Gas         | 1035 BTU/Ft <sup>3</sup> | NIL                | NIL             | 117/Ft <sup>3</sup> /HR      |
| #2 Oil              | 146,000 BTU/Gal          | 0.17               | NIL             | 3.55 Gal/Hr                  |
|                     |                          |                    |                 |                              |
|                     |                          |                    |                 |                              |

4. Burner Type (solid fuels only):    Pulverized    Traveling Grate  
   Underfeed Stoker    Other (specify) \_\_\_\_\_  
If flyash reinjection is to be used, give % reinjection. \_\_\_\_\_

5. Air Pollution Control Device Description: NONE

6. Stack Data:  
Height Above Ground 25 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter    ft Temperature \_\_\_\_\_ °F  
Est. Moisture    % Location (UTM or Lat/Long) Bldg 1046

7. Emission Rate at rated capacity (lb/hr):

| Pollutant          | Before Control Device | After Control Device | Method of Estimating Emissions |
|--------------------|-----------------------|----------------------|--------------------------------|
| Particulate Matter | .002                  | .017                 | AP 42 Dec 84                   |
| SO <sub>2</sub>    | .001                  | .012                 | AP 42 Dec 84                   |
| CO                 | .025                  | .045                 | AP 42 Dec 84                   |
| NO <sub>x</sub>    | .117                  | .137                 | AP 42 Dec 84                   |
| Other (specify):   |                       |                      |                                |
|                    |                       |                      |                                |
|                    |                       |                      |                                |

8. Are any wastes, in subject to provisions of the S.C. Hazardous Waste Management Act or Regulation, to be burned in this unit? (specify):   

9. Name of person who will be responsible for the operation of the unit: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone: \_\_\_\_\_

10. How will waste material from process and control equipment be disposed of? \_\_\_\_\_



SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

SHAW AFB  
Permit No.:

ID. No.:

Date:

Reviewed By: \_\_\_\_\_

**PART IIA**

1. Company Name: SHAW AFB Date: 20 Apr 88

Type of Fuel Burning Operation: Hot Water Boiler

Unit Designation: Bldg 1102 H/W Boiler

2. Make: Cleaner-Brooks Model: CB H186-S0

Capacity: Rated Input 1.95 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content     | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity |
|---------------------|-----------------|--------------------|-----------------|------------------------------|
| #2 Oil              | 140,000 BTU/Gal | 0.17               | NIL             | 14 gal/hr                    |
|                     |                 |                    |                 |                              |
|                     |                 |                    |                 |                              |

4. Burner Type (solid fuels only): \_\_\_\_\_ Pulverized \_\_\_\_\_ Traveling Grate

\_\_\_\_\_ Underfeed Stoker \_\_\_\_\_ Other (specify) \_\_\_\_\_

If flyash reinjection is to be used, give % reinjection. \_\_\_\_\_

5. Air Pollution Control Device Description: None

6. Stack Data:

Height Above Ground 25 ft Gas Velocity \_\_\_\_\_ ft/sec

Inside Diameter .62 ft Temperature \_\_\_\_\_ °F

Est. Moisture \_\_\_\_\_ % Location (UTM or Lat/Long) Bldg 1102

7. Emission Rate at rated capacity (lb/hr):

| Pollutant          | Before Control Device | After Control Device | Method of Estimating Emissions |
|--------------------|-----------------------|----------------------|--------------------------------|
| Particulate Matter | <u>.000</u>           |                      | <u>10-10-80-84</u>             |
| SO <sub>2</sub>    | <u>.000</u>           |                      | <u>10-10-80-84</u>             |
| CO                 | <u>.070</u>           |                      | <u>10-10-80-84</u>             |
| NH <sub>3</sub>    | <u>.000</u>           |                      | <u>10-10-80-84</u>             |
| Other (specify):   |                       |                      |                                |
|                    |                       |                      |                                |
|                    |                       |                      |                                |

8. Are any materials subject to prohibitions of the S.C. Hazardous Waste Management Act or Regulations to be burned in this unit? (specify): No

9. Normal operating schedule: \_\_\_\_\_ days per week, \_\_\_\_\_ hours per day, \_\_\_\_\_ days per year, \_\_\_\_\_ hours per year.

10. How will waste material from process and control equipment be disposed of? \_\_\_\_\_

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

PART IIA

BUREAU USE  
Permit No.:  
ID. No.:  
Date:  
Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88  
Type of Fuel Burning Operation: Steam Boiler Heating  
Unit Designation: Bldg 1130 Boiler

2. Make: Kewanee Model: \_\_\_\_\_  
Capacity: Rated Input 2,553 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content                    | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity  |
|---------------------|--------------------------------|--------------------|-----------------|-------------------------------|
| <u>Natural Gas</u>  | <u>1035 BTU/Ft<sup>3</sup></u> | <u>NIL</u>         | <u>NIL</u>      | <u>2476 Ft<sup>3</sup>/HR</u> |
| <u>72 OIL</u>       | <u>140,000 BTU/Gal</u>         | <u>1.1</u>         | <u>NIL</u>      | <u>13.3 Gal/HR</u>            |
|                     |                                |                    |                 |                               |
|                     |                                |                    |                 |                               |

4. Burner Type (solid fuels only): \_\_\_\_\_ Pulverized \_\_\_\_\_ Traveling Grate  
\_\_\_\_\_ Underfeed Stoker \_\_\_\_\_ Other (specify) \_\_\_\_\_  
If flyash reinjection is to be used, give % reinjection. \_\_\_\_\_

5. Air Pollution Control Device Description: None

6. Stack Data:  
Height Above Ground 25 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter .66 ft Temperature \_\_\_\_\_ °F  
Est. Moisture \_\_\_\_\_ % Location (UTM or Lat/Long): Bldg 1130

7. Emission Rate at rated capacity (lb/hr):

| Pollutant          | Before Control Device | After Control Device | Method of Estimating Emissions |
|--------------------|-----------------------|----------------------|--------------------------------|
| Particulate Matter | <u>.007</u>           | <u>.000</u>          | <u>16 12 Dec 81</u>            |
| SO <sub>2</sub>    | <u>.004</u>           | <u>.0</u>            | <u>12 11 Dec 81</u>            |
| CO                 | <u>.05</u>            | <u>.00</u>           | <u>12 11 Dec 81</u>            |
| NO <sub>x</sub>    | <u>.15</u>            | <u>.0</u>            | <u>12 11 Dec 81</u>            |
| Other (specify):   |                       |                      |                                |
|                    |                       |                      |                                |
|                    |                       |                      |                                |

8. Are any materials subject to provisions of the U.S. Hazardous Waste Management Act or Regulations to be burned in this unit? (specify): \_\_\_\_\_

9. Normal operating schedule: \_\_\_\_\_ how often \_\_\_\_\_ days week \_\_\_\_\_ month year  
\_\_\_\_\_ and \_\_\_\_\_ at \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_

10. How will waste material from process and control equipment be disposed of?  
11/1

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

PART IIA

BUREAU USE  
Permit No.:  
ID. No.:  
Date:  
Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88

2. Type of Fuel Burning Operation: Steam Boiler Heating

Unit Designation: Bldg 1200 Boilers #1 & #2

3. Make: Kewanee

Model:

Capacity: Rated Input 2.50 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content              | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity |
|---------------------|--------------------------|--------------------|-----------------|------------------------------|
| Natural Gas         | 1035 BTU/ft <sup>3</sup> | NIL                | NIL             | 2415 ft <sup>3</sup> /hr     |
| Oil                 | 140,000 BTU/gal          | 0.17               | NIL             | 18 gal/hr                    |
|                     |                          |                    |                 |                              |
|                     |                          |                    |                 |                              |

4. Burner Type (solid fuels only): \_\_\_\_\_ Pulverized \_\_\_\_\_ Traveling Grate  
\_\_\_\_\_ Underfeed Stoker \_\_\_\_\_ Other (specify) \_\_\_\_\_  
If flyash reinjection is to be used, give % reinjection. \_\_\_\_\_

5. Air Pollution Control Device Description: None

6. Stack Data:

Height Above Ground 30 ft Gas Velocity \_\_\_\_\_ ft/sec

Inside Diameter 1.5 ft Temperature \_\_\_\_\_ °F

Est. Moisture \_\_\_\_\_ % Location (UTM or Lat/Long) Bldg 1200

7. Emission Rate at rated capacity (lb/hr):

| Pollutant          | Before Control Device | After Control Device | Method of Estimating Emissions |
|--------------------|-----------------------|----------------------|--------------------------------|
| Particulate Matter | 0.07                  | 0.02                 | AP 42 Dec 84                   |
| SO <sub>2</sub>    | 0.01                  | 0.01                 | AP 42 Dec 84                   |
| CO                 | 0.04                  | 0.04                 | AP 42 Dec 84                   |
| NO <sub>x</sub>    | 0.01                  | 0.01                 | AP 42 Dec 84                   |
| Other (specify):   |                       |                      |                                |
|                    |                       |                      |                                |
|                    |                       |                      |                                |

8. Are any materials subject to provisions of the S.C. Hazardous Waste Management Act or its amendments to be burned in this unit? (specify): NO

9. Normal operating schedule: \_\_\_\_\_ days/week \_\_\_\_\_ weeks/year

\_\_\_\_\_ Mon.-Fri. \_\_\_\_\_ Sat.-Sun. \_\_\_\_\_

10. How will waste material from process and control equipment be disposed of?

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

BUREAU USE  
Permit No.:  
ID. No.:  
Date:  
Reviewed By:

PART IIA

1. Company Name: SHAW AFB Date: 20 Apr 88  
Type of Fuel Burning Operation: Steam Boiler Heating  
Unit Designation: Bldg 1200 Boiler #3

2. Make: Kewanee Model: \_\_\_\_\_  
Capacity: Rated Input 2.05 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content              | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity |
|---------------------|--------------------------|--------------------|-----------------|------------------------------|
| Natural Gas         | 1035 BTU/Ft <sup>3</sup> | NIL                | NIL             | 1931 Fm <sup>3</sup> /hr     |
| AC Fuel             | 140,000 BTU/Gal          |                    |                 | 12.3 Gal/hr                  |
|                     |                          |                    |                 |                              |
|                     |                          |                    |                 |                              |

4. Burner Type (solid fuels only): \_\_\_\_\_ Pulverized \_\_\_\_\_ Traveling Grate  
\_\_\_\_\_ Underfeed Stoker \_\_\_\_\_ Other (specify): \_\_\_\_\_  
If flyash reinjection is to be used, give % reinjection: \_\_\_\_\_

5. Air Pollution Control Device Description: \_\_\_\_\_

6. Stack Data:

Height Above Ground 30 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter 1.0 ft Temperature \_\_\_\_\_ °F  
Est. Moisture \_\_\_\_\_ % Location (UTM or Lat/Long) 7100 1100

7. Emission Rate at rated capacity (lb/hr):

| Pollutant          | Before Control Device | After Control Device | Method of Estimating Emissions |
|--------------------|-----------------------|----------------------|--------------------------------|
| Particulate Matter | 0.08 0.09             |                      | 12 12 12 12                    |
| SO <sub>2</sub>    | 0.08 0.08             |                      | 12 12 12 12                    |
| CO                 | 0.04 0.04             |                      | 12 12 12 12                    |
| NO <sub>x</sub>    |                       |                      | 12 12 12 12                    |
| Other (specify):   |                       |                      |                                |
|                    |                       |                      |                                |
|                    |                       |                      |                                |

8. Are any materials subject to provisions of the Solid Hazardous Waste Management Act or Regulations to be burned in this unit? (specify): \_\_\_\_\_

9. Will particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, or any other pollutant be emitted from this unit? (specify): \_\_\_\_\_

10. Will waste material from process and control equipment be disposed of? \_\_\_\_\_

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

PART IIA

BUREAU NO.  
Permit No.:

ID. No.:  
Date:  
Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88  
Type of Fuel Burning Operation: Steam Boiler Heating  
Unit Designation: Bldg 1206 Heating Boiler

2. Make: York Shipley Model: SPHW25-2-12915  
Capacity: Rated Input 1.05 x 10<sup>6</sup> BTU/hr - Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content                       | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity |
|---------------------|-----------------------------------|--------------------|-----------------|------------------------------|
| <u>#2 Oil</u>       | <u>140,000 BTU/Ft<sup>3</sup></u> | <u>0.17</u>        | <u>NIL</u>      | <u>7.5 Gal/hr</u>            |
|                     |                                   |                    |                 |                              |
|                     |                                   |                    |                 |                              |
|                     |                                   |                    |                 |                              |

4. Burner Type (solid fuels only): \_\_\_\_\_ Pulverized \_\_\_\_\_ Traveling Grate  
\_\_\_\_\_ Underfeed Stoker \_\_\_\_\_ Other (specify) \_\_\_\_\_  
If Flyash reinjection is to be used, give % reinjection. \_\_\_\_\_

5. Air Pollution Control Device Description: NONE

6. Stack Data:  
Height Above Ground 25 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter .60 ft Temperature \_\_\_\_\_ °F  
Est. Moisture \_\_\_\_\_ % Location (UTM or Lat/Long) 21N 100E

7. Emission Rate at rated capacity (lb/hr):

| Pollutant          | Before Control Device | After Control Device | Method of Estimating Emissions |
|--------------------|-----------------------|----------------------|--------------------------------|
| Particulate Matter | <u>.145</u>           |                      | <u>AP-42 Table 11</u>          |
| SO <sub>2</sub>    | <u>.131</u>           |                      | <u>AP-42 Table 11</u>          |
| CO                 | <u>.110</u>           |                      | <u>AP-42 Table 11</u>          |
| NO <sub>x</sub>    | <u>.110</u>           |                      | <u>AP-42 Table 11</u>          |
| Other (specify):   |                       |                      |                                |
|                    |                       |                      |                                |
|                    |                       |                      |                                |

8. Are any materials subject to provisions of the S.C. Hazardous Waste Management Act or Regulations to be burned in this unit? (Specify): \_\_\_\_\_

9. Normal operating hours: \_\_\_\_\_ days/week \_\_\_\_\_ hrs/day  
Emergency operating hours: \_\_\_\_\_ days/week \_\_\_\_\_ hrs/day

10. How will waste material from process and control equipment be disposed of?  
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SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

PART IIA

COPIES OF THIS  
PERMIT NO.:  
ID. No.:  
Date:  
Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88  
Type of Fuel Burning Operation: Hot Water Boiler Heating  
Unit Designation: Blldg 1402 Boiler #1

2. Make: Superior - Pawnee Model: C2-20-20A  
Capacity: Rated Input 1.512 x 10<sup>6</sup> BTU/hr Rated Output        x 10<sup>6</sup> BTU/hr  
       x 10<sup>3</sup> lbs of steam/hr        °F and        PSIG

3. Fuel Data (indicate all units):

| Fuel<br>Type and Grade | BTU<br>Content           | % Sulfur<br>by weight | % Ash<br>by weight | Consumption<br>@ rated capacity |
|------------------------|--------------------------|-----------------------|--------------------|---------------------------------|
| Natural Gas            | 1035 BTU/Ft <sup>3</sup> | NIL                   | NIL                | 1451 Ft <sup>3</sup> /hr        |
| Oil                    | 140,000 BTU/gal          | NIL                   | NIL                | 0.0 gal/hr                      |
|                        |                          |                       |                    |                                 |
|                        |                          |                       |                    |                                 |

4. Burner Type (solid fuels only):        Pulverized        Traveling Grate  
       Underfeed Stoker        Other (specify):  
If flyash reinjection is to be used, give % reinjection:       

5. Air Pollution Control Device Description:       

6. Stack Data:  
Height Above Ground 25 ft Gas Velocity        ft/sec  
Inside Diameter .36 ft Temperature        °F  
Est. Moisture        % Location (City or Lat/Long)       

7. Emission Rate at rated capacity (lb/hr):

| Pollutant          | Before<br>Control<br>Device | After<br>Control<br>Device | Method of Estimating<br>Emissions |
|--------------------|-----------------------------|----------------------------|-----------------------------------|
| Particulate Matter | <u>      </u>               | <u>      </u>              | <u>      </u>                     |
| SO <sub>2</sub>    | <u>      </u>               | <u>      </u>              | <u>      </u>                     |
| CO                 | <u>      </u>               | <u>      </u>              | <u>      </u>                     |
| NH <sub>3</sub>    | <u>      </u>               | <u>      </u>              | <u>      </u>                     |
| Other (specify):   | <u>      </u>               | <u>      </u>              | <u>      </u>                     |
|                    | <u>      </u>               | <u>      </u>              | <u>      </u>                     |
|                    | <u>      </u>               | <u>      </u>              | <u>      </u>                     |

8. Are any other air quality standards or regulations applicable to this unit? (specify):       

9. Are there any other air quality standards or regulations applicable to this unit? (specify):       

10. How will waste material from this unit be disposed of?

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

PART IIA

SCEA-00000000  
Permit No.:  
ID. No.:  
Date:  
Reviewed By:

1. Company Name: SHAW AFB Date: 27 Apr 88  
Type of Fuel Burning Operation: Hot Water Boiler Heating  
Unit Designation: Bldg 1422 Boiler

2. Make: Spencer Model: 4F-450-50W  
Capacity: Rated Input 3.015 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content            | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity |
|---------------------|------------------------|--------------------|-----------------|------------------------------|
| <u>2 Oil</u>        | <u>140,000 BTU/Gal</u> | <u>0.1</u>         | <u>NIL</u>      | <u>21.5 Gal/hr</u>           |
|                     |                        |                    |                 |                              |
|                     |                        |                    |                 |                              |
|                     |                        |                    |                 |                              |

4. Burner Type (solid fuels only):    Pulverized    Traveling Grate  
   Underfeed Stoker    Other (specify) \_\_\_\_\_  
If oxygen reinjection is to be used, give % reinjection: \_\_\_\_\_

5. Air Pollution Control Device Description:   

6. Stack Data:

Height Above Ground 25 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter .66 ft Temperature \_\_\_\_\_ °F  
Est. Moisture .3 Location (UTM or Lat/Long)   

7. Emission Rate at rated capacity (lb/hr):

| Pollutant          | Before Control Device | After Control Device | Method of Estimating Emissions |
|--------------------|-----------------------|----------------------|--------------------------------|
| Particulate Matter | <u>.023</u>           |                      |                                |
| SO <sub>2</sub>    | <u>.53</u>            |                      |                                |
| CO                 | <u>.10</u>            |                      |                                |
| NO <sub>x</sub>    | <u>.1</u>             |                      |                                |
| Other (specify):   |                       |                      |                                |
|                    |                       |                      |                                |
|                    |                       |                      |                                |

8. Is this unit subject to regulation under the Federal Air Quality Criteria for particulate matter or sulfur dioxide to be burned in this unit?   

9. Is this unit subject to regulation under the Federal Air Quality Criteria for carbon monoxide, nitrogen dioxide, or lead?   

10. Is this unit subject to regulation under the Federal Air Quality Criteria for hazardous air pollutants?

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

PART IIA

SHAW AFB  
Permit No.:  
ID. No.:  
Date:  
Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88  
Type of Fuel Burning Operation: Hot Water Boiler Heating  
Unit Designation: Bldg 1604 Boiler

2. Make: Burnham Model: R8-1-60-25  
Capacity: Rated Input 1.541 x 10<sup>6</sup> BTU/hr -- Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>6</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content            | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity |
|---------------------|------------------------|--------------------|-----------------|------------------------------|
| <u>#2 Oil</u>       | <u>140,000 BTU/Gal</u> | <u>0.17</u>        | <u>NIL</u>      | <u>11 Gal/HR</u>             |
|                     |                        |                    |                 |                              |
|                     |                        |                    |                 |                              |
|                     |                        |                    |                 |                              |

4. Fuel Type (solid fuels only):    Pulverized    Traveling Grate  
   Underfeed Stoker    Other (specify) \_\_\_\_\_  
Flyash being used is to be used. Give % reinsertion. \_\_\_\_\_

5. Air Pollution Control Device Description: None

6. Stack Data:

Height Above Ground 25 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter 10 in Temperature \_\_\_\_\_ °F  
Exit Moisture \_\_\_\_\_ % Location (UTM or Lat/Long) Bldg 1604

7. Emissions (at rated capacity (lb/hr))

|                           | Before Control Device | After Control Device | Method of Estimating Emissions |
|---------------------------|-----------------------|----------------------|--------------------------------|
| <u>Particulate Matter</u> | <u>0.02</u>           |                      | <u>AP 11 Sec 11</u>            |
| <u>CO</u>                 | <u>0.07</u>           |                      | <u>AP 12 Sec 1</u>             |
| <u>SO<sub>2</sub></u>     | <u>1.6</u>            |                      | <u>AP 17 Sec 1a</u>            |
| <u>NO<sub>x</sub></u>     | <u>0.2</u>            |                      |                                |

Other (specify): \_\_\_\_\_

8. Are there any other pollutants or substances which are not listed in the above table but which are emitted in this unit? (Specify) \_\_\_\_\_

9. Are there any other pollutants or substances which are not listed in the above table but which are emitted in this unit? (Specify) \_\_\_\_\_

10. Are there any other pollutants or substances which are not listed in the above table but which are emitted in this unit? (Specify) \_\_\_\_\_



SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
BUREAU OF AIR QUALITY CONTROL  
FUEL BURNING PERMIT APPLICATION

BUREAU USE  
Permit No. \_\_\_\_\_  
ID. No.: \_\_\_\_\_  
Date: \_\_\_\_\_  
Reviewed By: \_\_\_\_\_

PART IIA

1. Company Name: SHAW AFB Date: 20 Apr 88

Type of Fuel Burning Operation: Steam Boiler Heating

Unit Designation: Bldg 1614 Boilers (2)

2. Make: Kewanee Model: M335-KX  
Capacity: Rated Input 3.35 x 10<sup>6</sup> BTU/hr Rated Output \_\_\_\_\_ x 10<sup>6</sup> BTU/hr  
\_\_\_\_\_ x 10<sup>3</sup> lbs of steam/hr @ \_\_\_\_\_ °F and \_\_\_\_\_ PSIG

3. Fuel Data (indicate all units):

| Fuel Type and Grade | BTU Content              | % Sulfur by weight | % Ash by weight | Consumption @ rated capacity |
|---------------------|--------------------------|--------------------|-----------------|------------------------------|
| Natural Gas         | 1035 BTU/Ft <sup>3</sup> | NIL                | NIL             | 3237 Ft <sup>3</sup> /HR     |
| _____               | 140,000 BTU/Gal          | 0.17               | NIL             | 24 Gal/HR                    |
| _____               | _____                    | _____              | _____           | _____                        |
| _____               | _____                    | _____              | _____           | _____                        |

4. Burner Type (solid fuels only): \_\_\_\_\_ Pulverized \_\_\_\_\_ Traveling Grate  
\_\_\_\_\_ Underfeed Stoker \_\_\_\_\_ Other (specify) \_\_\_\_\_  
If flyash reinjection is to be used, give % reinjection. \_\_\_\_\_

5. Air Pollution Control Device Description: None

6. Stack Data:  
Height Above Ground 30 ft Gas Velocity \_\_\_\_\_ ft/sec  
Inside Diameter 1.0 ft Temperature \_\_\_\_\_ °F  
Est. Moisture \_\_\_\_\_ % Location (UTM or Lat/Long) Bldg 1614

7. Emission Rate at rated capacity (lb/hr):

|                           | Before Control Device | After Control Device | Method of Estimating Emissions |
|---------------------------|-----------------------|----------------------|--------------------------------|
| <u>Particulate Matter</u> | <u>.0097</u>          | <u>.043</u>          | <u>AP 42 Dec 84</u>            |
| CO <sub>2</sub>           | <u>.33</u>            | <u>.33</u>           | <u>AP 42 Dec 84</u>            |
| CO                        | <u>.05</u>            | <u>.12</u>           | <u>AP 42 Dec 84</u>            |
| SO <sub>2</sub>           | <u>.32</u>            | <u>.32</u>           | <u>AP 42 Dec 84</u>            |
| Other (specify):          | _____                 | _____                | _____                          |
| _____                     | _____                 | _____                | _____                          |
| _____                     | _____                 | _____                | _____                          |

8. Are any materials subject to provisions of the S.C. Hazardous Waste Management Act or Regulation, to be burned in this unit? (specify): \_\_\_\_\_

9. Fuel burning season: \_\_\_\_\_ hours per \_\_\_\_\_ days per \_\_\_\_\_  
seasonal variation: Dec.-Feb. \_\_\_\_\_ % Mar.-May \_\_\_\_\_ % June-Aug. \_\_\_\_\_ % Sept.-Nov. \_\_\_\_\_ %

10. How will waste material from process and control equipment be disposed of?  
\_\_\_\_\_

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**APPENDIX C**  
**State Regulations**

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## SOUTH CAROLINA AIR POLLUTION CONTROL REGULATIONS

(South Carolina Department of Health and Environmental Control; Regulation 61-62 — Air Pollution Control Regulations and Standards; Adopted July 26, 1972; As amended through May 28, 1981; December 16, 1982; April 22, 1983; June 24, 1983; May 24, 1985; May 23, 1986)

### CONTENTS

Regulation No. 62.1 — Air Pollution Control  
 Regulation No. 62.2 — Prohibition of Open Burning  
 Regulation No. 62.3 — Air Pollution Episodes  
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 Regulation No. 62.5 — Air Pollution Control Standards  
 [See page 506.1001]  
 Regulation No. 62.6 — Control of Fugitive Particulate Matter  
 Regulation No. 62.7 — Good Engineering Practice Stack Height

### REGULATION NO. 62.1 AIR POLLUTION CONTROL

#### Section 1 — Definitions

The following words and phrases when used in the Regulations and Standards shall for the purpose of these regulations have the meanings respectively ascribed to them in this section, unless a different meaning is clearly indicated. This section augments Section 1 of the South Carolina Pollution Control Act.

1. *Acid Mist* — Mist or droplets of sulfuric or other strong acids. Sulfuric acid mist includes sulfur trioxide (SO<sub>3</sub>) and sulfuric acid vapor as well as liquid mist.
2. *Add* — Additions to a process which will increase size, scope or emissions from such process.
3. *Alter* — Alter means modification or change in a process or processes which would affect emissions to the atmosphere.
4. *Ambient Air Quality Standards* — That standard for the quality of ambient air at or beyond a property line on which a source of pollution is emitting.

5. *Application* — Means a form provided by the Department which is prescribed to provide the information required to grant approval to construct and operate a source or an incinerator; or to report an existing incinerator.

6. *Board* — Board means Board of Health and Environmental Control.

7. *Commissioner* — Commissioner means the Commissioner of the Department of Health and Environmental Control.

8. *Department* — Department means the Department of Health and Environmental Control.

9. *Emission Data* — The definition contained in 40 CFR 2.301(a)(2), July 1, 1982, is incorporated by reference.

10. *Emission Limitation (and emission standard)* — A requirement established by the State or by the Administrator of the Environmental Protection Agency which limits the quantity, rate, or concentration of emissions of air pollutants on a continuous basis, including any requirements which limit the level of opacity, prescribe equipment, set fuel specifications, or prescribe operation or maintenance procedures for a source to assure continuous emission reduction.

11. *Fuel Burning Operation* — Use of furnace, boiler, device or mechanism used principally but not exclusively, to burn any fuel for the purpose of indirect heating in which the material being heated is not contacted by and adds no substance to the products of combustion.

12. *Fugitive Dust* — A type of particulate emission that becomes airborne by forces of wind, man's activity or both, including but not limited to, construction sites, tilled land, materials storage piles, and materials handling.

13. *Fugitive Emissions* — Air contaminants which escape to the air not through an exhaust system, but

through other means, including but not limited to, windows, vents, doors, ill-fitting closures or poorly maintained equipment

14. *Garbage* — Animal and vegetable waste resulting from the handling, preparation, cooking and serving of foods.

15. *Hazardous Air Pollutant* — A pollutant which is the subject of National Emission Standards for Hazardous Air Pollutants promulgated by the United States Environmental Protection Agency by publication in the Federal Register

16. *Incinerator* — An engineered apparatus and all appurtenances thereto, designed to reduce combustible solid, semi-solid, liquid, or gaseous waste by high temperature burning

17. *Kraft pulp mill* — Any stationary source which produces pulp from wood by cooking (digesting) wood chips in a water solution of sodium hydroxide and sodium sulfide (white liquor) at a high temperature and pressure. Regeneration of the cooking chemicals through a recovery process is also considered part of the kraft pulp mill

18. *Major Plant* — Except as otherwise provided, this term refers to any plant which directly emits, or has the potential to emit, one hundred tons per year or more of any regulated air pollutant.

19. *Mass Emission Rate* — The weight discharged per unit of time.

20. *Opacity* — The degree to which emissions reduce the transmission of light and obscure the view of an object in the background.

21. *Open Burning* — Any fire or smoke-producing process which is not conducted in any boiler plant, furnace, high-temperature processing unit, incinerator or flare, or in any other such equipment primarily designed for the combustion of fuel or waste material

22. *Particulate Matter* — Any material, except uncombined water, that exists in a finely divided form as a liquid or solid at standard conditions.

23. *Plant* — Except as otherwise provided, any stationary source or combination of stationary sources, which is located on one or more contiguous or adjacent properties and owned or operated by the same person(s) under common control

24. *Potential to Emit* — The maximum capacity of a plant to emit a regulated pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the plant to emit a regulated pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed,

shall be treated as part of its design only if the limitation or the effect it would have on emissions is federally enforceable. Secondary emissions do not count in determining the potential to emit of a plant.

25. *Process Industry* — Any source engaged in the manufacture, processing, handling, treatment, forming, storing or any other action upon materials except fuel-burning operations

26. *Process Weight* — The total weight of all materials introduced into a source operation, including air and water where these materials become an integral part of the product, and solids used as fuels but excluding liquids and gases used solely as fuels.

27. *Process Weight Rate* — A rate established as follows:

(a) For continuous or long-run steady-state source operations, the total process weight for the entire period of continuous operation or for a typical portion thereof, divided by the number of hours of such period or portion thereof.

(b) For cyclical or batch unit operations, or unit processes, the total process weight for a period that covers a complete operation or an integral number of cycles, divided by the hours of actual process operation during such a period

Where the nature of any process or operation or the design of an equipment is such as to permit more than one interpretation of this definition, the interpretation that results in the minimum value for allowable emission shall apply.

28. *Refuse* — Garbage, rubbish and/or trade waste.

29. *Rubbish* — Solid wastes from residences and dwellings, commercial establishments, and institutions.

30. *Salvage Operations* — Any operation of a business, trade, or industry engaged in whole or in part in salvaging or reclaiming any product or material, including, but not limited to, metals, chemicals, shipping containers, drums or automobiles

31. *Secondary Emissions* — Emissions which would occur as a result of the construction or operation of a major plant or major modification, but do not come from the major plant or major modification itself. Secondary emissions must be specific, well defined, quantifiable, and must impact the same general area as the plant or modification which causes the secondary emissions. Secondary emissions may include, but are not limited to:

(a) emissions from ships or trains moving to or from the new or modified plant

(b) emissions from any offsite support facility operation which would not otherwise be constructed or increase its emissions as a result of the construction or operation of the major plant or major modification

32. *Smoke* — Small gas-borne and airborne particles arising from a process of combustion in sufficient number to be observable by a person of normal vision under normal conditions.

33. *Solid Fuel* — A fuel which is fired as a solid such as coal, lignite and wood.

34. *Stack* — Any flue, conduit, duct, chimney, or opening arranged to conduct an effluent into the open air.

35. *Stack Height* — The vertical distance measured in feet between the point of discharge from the stack or chimney into the outdoor atmosphere and the elevation of the land thereunder.

36. *Standard Conditions* — 760 millimeters of mercury at 25 degrees Centigrade.

37. *Stationary Source* — Any building, structure, installation or process which emits or may emit an air pollutant subject to regulation by any national or state standard. Use of the term "source" is to be construed to mean "stationary source."

38. "Total reduced sulfur (TRS)" means the sum of the sulfur compounds hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide, that are released during the kraft pulping operation and measured by Federal Reference Method 16.

39. *Trade Waste* — All solid, liquid, or gaseous material or rubbish resulting from construction, building operations, or the prosecution of any business, trade or industry including, but not limited to, plastic products, cartons, paint, grease, oil and other petroleum products, chemicals and cinders.

40. *Volatile Organic Compound (VOC)* — any chemical compound containing carbon which has a vapor pressure greater than one-tenth (0.1) mmHg at standard conditions excluding:

1. methane
2. ethane
3. 1,1,1-trichloroethane (methyl chloroform)
4. benzene
5. acetonitrile
6. chloroform
7. carbon tetrachloride
8. ethylene dichloride
9. ethylene dibromide
10. methylene chloride
11. trichlorofluoromethane (CFC-11)
12. dichlorodifluoromethane (CFC-12)
13. chlorodifluoromethane (CFC-22)
14. trifluoromethane (FC-23)
15. trichlorotrifluoroethane (CFC-113)
16. dichlorotetrafluoroethane (CFC-114)
17. chloropentafluoroethane (CFC-15)
18. carbon monoxide
19. carbon dioxide

20. carbonic acid

21. ammonium carbonate

22. metallic carbides or carbonates

## SECTION II - PERMIT REQUIREMENTS

### A. Construction Permit

#### 1. Applicability

Any person who plans to construct, alter or add to a source of air contaminants, including installation of any device for the control of air contaminant discharges, shall first obtain a construction permit from the Department. The Department may grant permission to proceed with minor alterations or additions without issuance of a permit when the Department determines that the alteration or addition will not increase the quantity and will not alter the character of the source's emissions.

#### 2. Permit Application

Construction permit applications shall be reviewed and signed by a professional engineer registered to practice in the State of South Carolina and shall provide, as a minimum, the following information:

- a. The name and location of the plant and its planned operating schedules;
- b. Sufficient description including physical and chemical properties of materials and processes necessary for the Department to determine actual and potential emissions;
- c. Identification of all emission points;
- d. A description, including physical and chemical properties of all emissions.
- e. A complete description including engineering design and operating characteristics of any air pollution control device or system that is to be installed; and
- f. Source information and calculations to demonstrate compliance with "Good Engineering Practice Stack Height" rules; and
- g. Other information as may be necessary for proper evaluation of the proposed source as determined by the Department.

Package-type incinerators of 750 pounds/hr rated capacity or smaller which burn types 0 and 1 wastes as defined by the Incinerator Institute of America and package-type boilers of  $100 \times 10^6$  BTU/hr input capacity or smaller which burn natural gas or oil as fuel are exempt from the requirement that the construction permit applications be prepared and submitted by a registered professional engineer provided the proposed unit is identical to a proto-type model which has been previously designed or otherwise certified by a professional engineer.

### B. Operating Permit

#### 1. Original

A written request to obtain an operating permit shall be submitted to the Department no later than fifteen (15) days prior to placing any new, increased or altered source into operation.

## 2. Renewal

Prior to the expiration date of a source's operating permit, the source will be inspected by the Department in order to decide whether to renew the permit. The past record of compliance and future probability of compliance will be given appropriate weight in making the decision regarding renewal.

Any special condition in a permit should be verified during the inspection and specifically mentioned in the report. Any additional provisions that the inspector believes warrants inclusion in the renewed permit are to be clearly and concisely stated in the inspection report.

## C. Standard Permit Conditions

All permits shall contain, in addition to such special conditions as the Department finds appropriate, the following standard conditions:

1. No applicable law, regulation or standard will be contravened.

2. All official correspondence, plans, permit applications and written statements are an integral part of the permit.

3. For sources not required to have continuous emission monitors, any malfunction of air pollution control equipment or system, process upset or other equipment failure which results in discharges of air contaminants lasting for one hour or more and which are greater than those discharges described for normal operation in the permit application shall be reported to the Department within twenty-four hours after the beginning of the occurrence and a written report submitted to the Department within thirty (30) days. The written report shall include as a minimum, the following:

a. The identity of the stack and/or emission point where the excess emissions occurred.

b. The magnitude of the excess emissions expressed in the units of the applicable emission limitation and the operating data and calculations used in determining the excess emissions.

c. The time and duration of the excess emissions.

d. The identity of the equipment causing the excess emissions.

e. The nature and cause of such excess emissions.

f. The steps taken to remedy the malfunction and the steps taken or planned to prevent the recurrence of such malfunction.

g. The steps taken to limit the excess emissions.

h. Documentation that the air pollution control equipment, process equipment, or processes were at all times maintained and operated, to the maximum extent practi-

cable, in a manner consistent with good practice for minimizing emissions.

4. Sources required to have continuous emission monitors will make quarterly reports as specified in applicable parts of the Regulations.

## D. Exceptions

1. Upon request, the Department may alter operating permits, compliance schedules, or other restrictions on operation of a source provided that resulting ambient air concentration levels will not exceed any national or state ambient air quality standard. Factors to be considered by the Department may include, but are not limited to, technology, economics, national energy policy, and existing air quality. The request by the source must also show the following:

a. Good faith efforts have been made to comply with the state requirements.

b. The source is unable to comply with the state requirements because the necessary technology or other alternative methods of control are not reasonably available, or have not been available for a sufficient period of time.

c. Any available operating procedures, or control measures, reducing the impact of the source on ambient air concentrations, have been implemented.

d. The request is submitted in a timely manner.

2. The provisions of this paragraph shall not apply to mass emission limits which are imposed upon any source by the following requirements:

a. Federal New Source Performance Standards;

b. National Emission Standards for Hazardous Air Pollutants;

c. Federal or State Prevention of Significant Deterioration Regulations; or,

d. Non-attainment requirements.

3. Where a permanent increase in the visible emission limitation for a source is requested, the source must demonstrate that it will remain in compliance with the applicable particular emission standard.

4. Any alternative compliance schedule shall provide for compliance with the applicable regulations as expeditiously as practicable, based on a plan submitted with the request for the alternative compliance schedule.

5. Any request under this section will be subjected to public notice and opportunity for a public hearing. Upon approval by the Board, the recommendations of this Department shall be sent to the Administrator of the Environmental Protection Agency, or his designated representative, for approval or disapproval.

6. Where alternative compliance schedule provisions are contained elsewhere in the air pollution control regulations, those provisions shall supersede the requirements in this section.



**E. Transfer of Ownership/Operation**

Whenever the ownership/operation of a source has been transferred, the Bureau shall be notified by the new owner/operator within thirty (30) days of the transaction. A transfer of the operation or construction permit will be effective upon written approval by the Department.

**F. Exemptions**

1. No permits shall be required for the following sources constructed prior to February 11, 1971:

- a. Natural gas boilers.
- b. Oil-fired boilers of  $50 \times 10^6$  BTU/HR rated input capacity or smaller.
- c. Coal-fired boilers of  $20 \times 10^6$  BTU/HR rated input capacity or smaller.

2. No permits shall be required for the following sources:

- a. Boilers and space heaters of less than  $1.5 \times 10^6$  BTU/HR rated input capacity.
- b. Comfort air-conditioning or ventilation systems.
- c. Motor vehicles.
- d. Laboratory hoods.
- e. Emergency power generators of less than 150 KW rated capacity.

f. Sources emitting only steam, air, nitrogen, oxygen, carbon dioxide, or any physical combination of these.

g. Sources with an uncontrolled particulate emission rate of less than 1 lb/hr and/or uncontrolled VOC emission rate of less than 1000 lbs/mo. may not require permits. However, source information needs to be submitted to the Department and a determination on the need for permits will be made. This determination will take into consideration, but will not be limited to, the nature and amount of the pollutants, location, proximity to residences and commercial establishments, etc.

h. Sources whose only emissions are fugitive must submit source information, and the need for permit(s) will be made by the Department on a case by case basis. This determination will take into consideration, but will not be limited to, the nature and amount of the pollutants, location, proximity to residences and commercial establishments, etc.

**SECTION III — EMISSIONS INVENTORY**

Emissions inventory is a study or compilation of pollutant emissions. Emissions inventories are designed to locate air pollution sources, to define the type and size of sources, to define the type and amount of emissions from each source, to determine pollutant frequency and duration, to determine the relative contributions to air pollution problems of classes of sources and of individual sources and to determine the adequacy of regulations and standards.

The emissions inventory for all major plants will be reviewed annually. Information required for this review will include, but is not limited to, the following:

- A. Information on fuel burning equipment.
- B. Types and quantities of fuel used;
- C. Fuel analysis;
- D. Exhaust parameters;
- E. Raw process materials and quantities used.
- G. Design and normal process rates;
- H. Hours of operation;
- I. Significant emission generating points or processes.
- J. Any desired information listed in 40 CFR 51, Appendix E (July 1, 1982).

Every even calendar year a new updated emissions inventory will be completed by the plant. All applicable information will be recorded on the current form for reporting emission data.

In the intervening calendar years, any change in emission data will be recorded on the annual compliance inspection report.

The above requirements notwithstanding, an emissions inventory may be required at any time in order to determine the compliance status of any plant.

**REGULATION NO. 62.2****PROHIBITION OF OPEN BURNING**

Open burning is prohibited except as provided below:

A. Open burning of leaves, tree branches or yard trimmings originating on the premises of private residences and burned on those premises.

B. Open burning in connection with the preparation of food for immediate consumption.

C. Campfires and fires used solely for recreational purposes, ceremonial occasions, or human warmth.

D. Fires purposely set to forest lands for specific forest management purposes in accordance with practices acceptable to the Department and as administered by the South Carolina Forestry Commission. Such management practices shall include:

1. Prescribed burning under existing standards for various management objectives; and

2. Site preparation burning for purposes of clearing an area for regeneration.

E. Fires purposely set for agricultural control of diseases, weeds, pests and other specific agricultural purposes in accordance with practices acceptable to the Department of Health and Environmental Control.

F. Open burning of trees, brush, grass and other vegetable matter for game management purposes in accordance with practices acceptable to the Department of Health and Environmental Control.

## SOUTH CAROLINA AMBIENT AIR QUALITY STANDARDS

(South Carolina Department of Health and Environmental Control; Regulation 61-62.5 — Air Pollution Control Standards; As last amended April 25, 1984; May 24, 1985; January 23, 1986)

### CONTENTS

Standard No. 1 — Emissions from Fuel Burning Operations  
Standard No. 2 — Ambient Air Quality Standards  
Standard No. 3 — Emissions from Incinerators  
Standard No. 4 — Emissions from Process Industries  
Standard No. 5 — Volatile Organic Compounds

### REGULATION NO. 62.5 AIR POLLUTION CONTROL STANDARDS

#### STANDARD NO. 1 EMISSIONS FROM FUEL BURNING OPERATIONS

#### SECTION I — VISIBLE EMISSIONS

##### A. Existing Sources

No one shall discharge to the ambient air from any existing source constructed prior to February 11, 1971, smoke which exceeds an opacity of forty (40) percent. For a total of six (6) minutes in one hour or twenty-four (24) minutes in a twenty-four (24) hour period, forty (40) percent opacity

may be exceeded for soot blowing; but shall in no case exceed an opacity of sixty (60) percent.

##### B. New Sources

No one shall discharge to the ambient air from any source constructed on or after February 11, 1971, smoke which exceeds an opacity of twenty (20) percent. For a total of six (6) minutes in one hour or twenty-four (24) minutes in a twenty-four (24) hour period, twenty (20) percent opacity may be exceeded for soot blowing; but shall in no case exceed an opacity of sixty (60) percent.

##### C. Special Provisions

The opacity standards set forth above do not apply during startup or shutdown. Owners and operators shall, to the extent practicable, maintain and operate any source including associated air pollution control equipment in a manner consistent with good air pollution control practices for minimizing emissions. In addition, the owner or operator shall maintain a log of the time, magnitude, duration and any other pertinent information to determine periods of startup and shutdown and make available to the Department upon request.

### SECTION II — PARTICULATE EMISSIONS

#### A. Allowable Discharge

The allowable discharge of particulate matter resulting from fuel burning operations shall be limited to the values obtained by use of Figure 1 and/or Part B. (For the purpose of determining heat input, total equipment capacity refers to total equipment capacity discharging through each stack. If a boiler has more than one (1) stack the total rated capacity will be the boiler rated capacity discharging to these stacks). Interpolation of Figure 1 for fuel burning operations of 1300 million BTU per hour heat input and larger shall be accomplished by use of the equation:

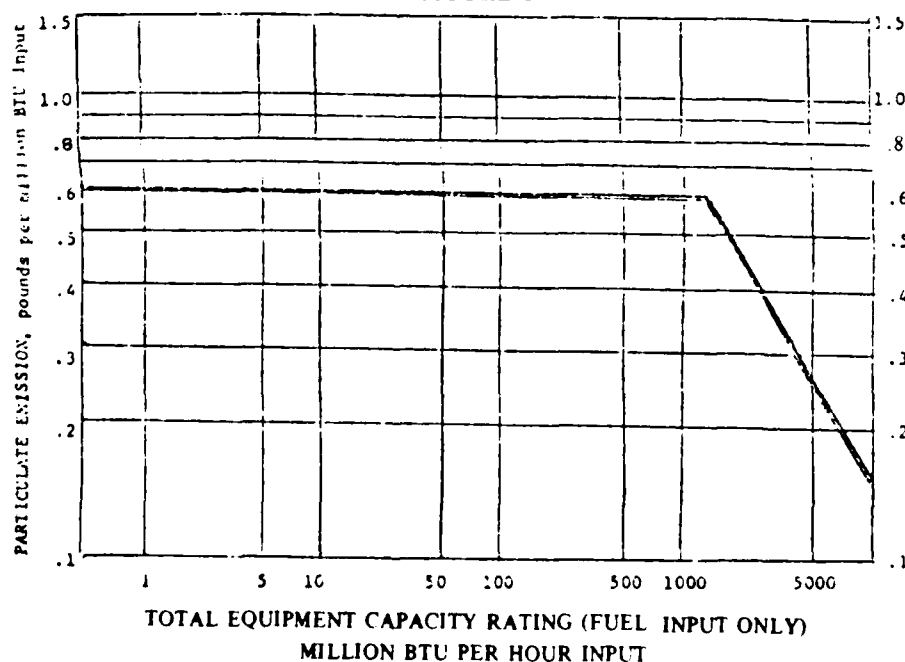
$$E = 57.84 P^{.667}$$

where E = the allowable emission rate in pounds per million BTU heat input, and P = million BTU heat input per hour

#### B. Special Provisions

All fuel burning operations of 10 million BTU per hour heat input and smaller constructed prior to February 11, 1971 shall be allowed 0.8 pounds per million BTU input.

FIGURE 1



## SECTION III — SULFUR DIOXIDE EMISSIONS

### A. General

The maximum allowable discharge of sulfur dioxide ( $\text{SO}_2$ ) from fuel burning operations shall be in accordance with a system of priorities as specified hereinafter in paragraph B. The classifications shall be delineated on a county basis. The maximum allowable discharge for the various classes is specified in paragraph C of this Section.

### B. Classifications

1. The class into which a given county falls has been determined by mathematical atmospheric diffusion models and other methods which evaluate those factors which necessitate limits on sulfur dioxide emissions. These factors included but were not limited to: (1) total sulfur dioxide emissions, (2) spatial distribution of sulfur dioxide sources, (3) effects of single, large sources, (4) existing, measured air quality, (5) topographical features of the county, (6) contributions to background levels due to sources outside the county being considered, (7) population density.

2. The assigned classifications will be reviewed periodically at intervals not to exceed three years, and changes will be made as required. When a county is assigned to a more restrictive class, individual compliance schedules will be established in such a way that reasonable time will be allowed for the source to make necessary changes in equipment and/or fuel contracts.

3. The following classifications are assigned:

Class I — Charleston County

Class II — Aiken County — Anderson County

Class III — All others

### C. Allowable Discharges

Sulfur dioxide emissions from fuel burning sources located in various counties will not exceed the following limits:

#### 1. Counties in Class I

| Rated Source Size                     | Maximum Allowable Emissions<br>(lb $\text{SO}_2$ /million BTU Input) |
|---------------------------------------|--|
| Up to and including 10 million BTU/hr | 3.5  |
| Greater than 10 million BTU/hr        | 2.3  |

#### 2. Counties in Class II

| Rated Source Size                     | Maximum Allowable Emissions<br>(lb $\text{SO}_2$ /million BTU Input) |
|---------------------------------------|--|
| Up to and including 10 million BTU/hr | 2.3  |
| Greater than 10 million BTU/hr        | 2.3  |

#### 3. Counties in Class III

| Rated Source Size | Maximum Allowable Emissions<br>(lb $\text{SO}_2$ /million BTU Input) |
|-------------------|--|
| All               | 3.5  |

### D. Special Provisions

If it can be demonstrated to the satisfaction of the Board that ambient air standards will not be contravened by a source, alone or in combination with other sources, a greater allowance for sulfur dioxide discharges may be made on a case by case basis.

## SECTION IV — OPACITY MONITORING REQUIREMENTS

### A. Applicable Sources

1. Fossil Fuel Fired Boilers. The owner or operator of any fossil fuel-fired steam generator of more than 250 million BTU per hour heat input capacity shall install, calibrate, operate, and maintain no later than June 14, 1978, continuous monitoring system(s) for the measurement of opacity which meets the performance specifications of Paragraph D of this Section except where:

a. Gaseous fuel is the only fuel burned,

b. Oil or a mixture of gas and oil are the only fuels burned and the steam generator is able to comply with the provisions of Sections I and II of this Standard without utilization of particulate matter collection equipment, and where the steam generator has never been found, through any administrative or judicial proceedings, to be in violation of Section I of this Standard.

c. The steam generator operates with an annual average capacity factor of 30 percent or less, as reported to the Federal Power Commission for calendar year 1974 or otherwise adequately demonstrated to the Department; and has not subsequently increased this factor to more than 30 percent.

2. Woodwaste Boilers. The owner or operator of any woodwaste boiler, not equipped with a wet scrubber, will be required to install, calibrate, operate and maintain continuous monitoring system(s) approved by this Department for the measurement of opacity, if it meets one or more of the following criteria:

a. Any woodwaste boiler of at least 60,000 lb steam/hr rated output.

b. Any woodwaste boiler, regardless of size, that has been operating in non-com-

pliance with any applicable state air pollution control regulations and standards.

If a boiler is fired on more than one fuel, the total capacity will determine the applicability of above requirements.

### B. Continuous Opacity Monitor Reporting Requirements

The owner or operator of any fossil fuel-fired steam generator subject to the provisions of Paragraph A of this Section shall submit a written continuous Opacity Monitor report to the Department at least quarterly, or more often if requested. All quarterly reports must be postmarked by the 30th day following the end of each calendar quarter.

The report shall include the following minimum information:

a. All integrated six minute opacity measurements for periods during which the applicable provisions of Section I have been exceeded, together with their nature and cause.

b. For periods of monitoring system malfunction:

(i) The date and time identifying each period during which the monitoring system was inoperative, except for zero and span checks.

(ii) The nature of monitoring system repairs or adjustments.

(iii) Proof of opacity monitoring system performance may be required by the Department whenever repairs or adjustments have been made.

c. boiler system repairs or adjustments made to correct violations of the provisions of Section I.

If no reportable incidents occur during a quarter, a report is also required indicating as such.

2. Alternative data reporting procedures may be allowed if the owner or operator shows, to the satisfaction of the Department, that these procedures are at least as accurate as those described.

3. The owner or operator shall maintain a file of all information contained in the quarterly reports, calibration data for the opacity monitoring system(s), relevant records of adjustments and maintenance performed on such system(s), and all other data generated by the continuous opacity monitoring system(s), for a minimum of two years from the date of submission of such reports or collection of such data.

The information contained on file must be made available for review by Department personnel upon request.

### C. Exemption from Reporting Requirements

A temporary exemption from the opacity monitoring and reporting requirements of this Section may be granted during any period of monitoring system(s) malfunction, provided the owner or operator shows, to the satisfaction of the Department, that the malfunction was unavoidable and is being repaired as expeditiously as possible.

### D. Equipment Performance Specifications

The continuous opacity monitoring system(s) required by Paragraph A.1 of this Section for fossil fuel fired steam generators shall conform with the performance specifications set forth in 40 CFR, part 60, Appendix B, Performance Specification 1 which is incorporated by reference as a part of this Standard except that where the term "Administrator" is used the term "Department" shall be substituted. In addition, the opacity monitoring system(s) shall complete a minimum of one cycle of operation for each successive 10-second period; be installed such that representative measurements of opacity from the affected steam generator are obtained; and have an instrument span of approximately 80 percent opacity.

The owner or operator shall record the zero and span drift in accordance with the method prescribed by the manufacturer of such opacity monitoring system(s); subject the system(s) to the manufacturer's recommended zero and span check at least once daily unless the manufacturer has recommended adjustments at shorter intervals, in which case such recommendations shall be followed; adjust the zero and span whenever the 24-hour zero drift or 24-hour calibration drift limits of 40 CFR, Part 60, Appendix B, Performance Specification 1 are exceeded; adjust the opacity monitoring system(s) purchased prior to September 11, 1974 whenever the 24-hour zero drift or 24-hour calibration drift exceeds 4 percent opacity for those generators constructed prior to February 11, 1971 and 2 percent opacity for those generators constructed after February 11, 1971.

The monitoring systems must be approved by this agency prior to installation.

### E. Monitor Location

When the effluents from two or more affected steam generators of similar design and operating characteristics are combined before being released to the atmosphere, the opacity monitoring system(s) shall be installed on the combined effluent. When the affected steam generators are not of similar design and operating characteristics, or when the effluent from one affected steam generator is released to the atmosphere through more than one point, the owner or operator shall apply for an alternate procedure to comply with the requirements of this Section.

### F. Exemptions from Monitoring Requirements

Whenever the requirements for continuous opacity monitoring cannot be implemented by the owner or operator due to physical plant limitations, extreme economic burden, or infrequent steam generator operation of less than 30 days per year, or when the specified monitoring procedure would not provide accurate opacity determinations, alternate monitoring and reporting requirements may be approved on a case-by-case basis provided the owner or operator submits a written request to the Department which includes, but not limited to:

1. The basis of reason(s) that alternate requirements are necessary;
2. A proposal of the alternate monitoring and reporting requirements; and
3. Any other information needed by the Department to make a determination that the alternate requirements are adequate to meet the intent of this Section.

### SECTION V — EXEMPTIONS

The following sources shall be exempt from the provisions of this standard:

- A. Residences of four families or less.
- B. Ocean-going vessels actually engaged in the physical process of national or international trade or defense.

### SECTION VI — PERIODIC TESTING

Scheduled periodic tests for particulates will be required of the sources listed below every two years, or as required by permit conditions to demonstrate compliance with this Standard. Compliance with sulfur dioxide will be by source testing, continuous monitoring, or fuel analysis as required by the permit conditions.

- A. Oil-fired boilers greater than 250 × 10<sup>3</sup> BTU/hr rated input.

- B. Coal-fired boilers greater than 50 × 10<sup>3</sup> BTU/hr rated input.

- C. Woodwaste, or combination woodwaste boilers greater than 20 × 10<sup>3</sup> BTU/hr rated input.

### SECTION VII — SOURCE TEST REQUIREMENTS

A. The owner or operator required to comply with Section VI above shall conduct such tests as required by the Department in order to demonstrate compliance with this Standard. EPA test methods or such alternative methods as approved by the Department prior to testing.

Tests shall be conducted while the source is operating at the expected maximum production rate or other production rate or operating conditions which would result in the highest emissions. Any production rate less than rated capacity may result in production limitations on the permits.

All tests shall be made by, or under the direction of, a person qualified by training and/or experience in the field of air pollution testing.

B. Any source owner or operator proposing to conduct tests in accordance with paragraph A. above shall notify the Department in the manner set forth below of the intent to test, not less than two weeks before the proposed initiation of the tests so the Department may observe the test if it desires to do so.

Notification shall include the following minimum information:

1. the purpose of the proposed test;
2. a description of the source to be tested;
3. a description of the test procedures, equipment, and sampling sites;
4. a timetable setting forth the dates on which the testing will be started and concluded.

C. The final test results must be submitted no later than 30 days after completion of the on-site testing, containing as a minimum, the following:

1. process weight rates (lb/hr)
2. process design and load rates at which the test was conducted
3. procedure used for determining process weight rates
4. calculations used to determine process weight rates
5. signature of responsible company official

D. The owner or operator proposing a source test under the provisions of this section shall be responsible for providing

1. sampling ports, pipes, lines, or appurtenances for the collection of samples and data required by the test procedure

2. safe access to the sample and data collection locations

3. light, electricity, and other utilities required for sample and data collection

E. Any proposed deviations from the procedures and requirements stated above must be thoroughly explained and must be approved by this Department prior to testing. Failure to observe any of these proce-

dures or requirements may be grounds for not accepting the tests

## STANDARD NO. 2 AMBIENT AIR QUALITY STANDARDS

The following table constitutes the ambient air quality standards for the State of South Carolina. The analytical methods to be used will be those applicable Federal Reference Methods published in 40 CFR 51, Appendices A-F. In the case of fluorides either the double paper tape sampler methods (ASTMD-3266-73T) or the sodium bicarbonate-coated glass tube and particulate filter methods (ASTM-3268-73T) may be used

| POLLUTANT                    | MEASURING INTERVAL (1)(2) | MEASURING MICROGRAMS/CUBIC METER |
|------------------------------|---------------------------|----------------------------------|
| Sulfur Dioxide               | 3 hour                    | 1300 (4)                         |
|                              | 24 hours                  | 365 (4)                          |
|                              | annual                    | 80                               |
| Suspended Particulates       | 24 hours                  | 250                              |
|                              | annual G.M. (3)           | 60                               |
| Carbon Monoxide              | 1 hour                    | 40 mg per cubic meter            |
|                              | 8 hour                    | 10 mg per cubic meter            |
| Ozone                        | 1 hour                    | 0.12 ppm (5)                     |
| Gaseous Fluorides<br>(as HF) | 12 hr. avg.               | 3.7                              |
|                              | 24 hr. avg.               | 2.9                              |
|                              | 1 wk. avg.                | 1.6                              |
|                              | 1 mo. avg.                | 0.8                              |
| Nitrogen Dioxide             | annual                    | 100                              |
| Lead                         | Calendar Quarterly Mean   | 1.5                              |

(1) Arithmetic Average except in case of suspended particulates

(2) At 25° C and 760 mm Hg.

(3) Geometric Mean

(4) Not to be exceeded more than once a year

(5) Not to be exceeded more than one day per year

## STANDARD NO. 3 EMISSIONS FROM INCINERATORS

All incinerators shall operate within the following emission limitations:

A. Particulates in the flue gas discharged into the atmosphere shall not exceed 0.5

pounds per million BTU of heat input to the incinerator, excluding auxiliary fuel

B. Emissions shall not produce smoke which exceeds twenty (20) percent opacity for an aggregate of more than six (6)

minutes in any one hour or twenty-four (24) minutes in a twenty-four hour period

C. Odors from the incinerator shall be reduced to such a level as not to create an undesirable level

D. Emissions shall not contain individual particles which are sufficiently large as to be visible as individual particles at the emission point or are of such size and nature as to be visible individually as incandescent particles. This requirement shall only apply if particles fall on real property other than that of the person responsible for the emission

## STANDARD NO. 4 EMISSIONS FROM PROCESS INDUSTRIES

### SECTION I — GENERAL

A. The method which is approved by the Department for determining compliance with opacity limitations under this Standard is EPA Reference Method 9 (40 CFR 60, Appendix A, as revised July 1, 1984). Alternate methods may be utilized only if approved in advance by the Department and by the Environmental Protection Agency.

B. This standard will not supersede any requirements imposed by Federal New Source Performance Standards, National Emission Standards for Hazardous Air Pollutants, Federal or State Prevention of Significant Deterioration Regulations, nor special permit conditions, unless this Standard would impose a more restrictive emission limit.

### SECTION II — SULFURIC ACID MANUFACTURING

A. The rate of emissions of sulfur dioxide from sulfuric acid manufacturing shall be limited to no more than 4 pounds of sulfur dioxide per ton of 100% sulfuric acid produced and emissions of acid mist to 0.5 pounds of sulfuric acid per ton of 100% acid produced.

B. The maximum allowable stack outlet opacity from any source under this category is 20%.

### SECTION III — KRAFT PULP AND PAPER MANUFACTURING

The rate of emissions from kraft pulp and paper manufacturing shall be limited to the following:

|                  | Maximum allowable Stack Opacity | Maximum allowable emission of particulates in pounds/equivalent ton of air dried, unbleached pulp produced |
|------------------|---------------------------------|--|
| Recovery Furnace | 40%                             | 2.75   |
| Dissolving Tank  | 20%                             | 1.0  |
| lime Kiln        | 20%                             | 1.0  |

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## **APPENDIX D**

### **Building 403, Steam Boilers 2, 3 and 5 Field Data**

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# PARTICULATE SAMPLING DATA SHEET

## SCHEMATIC OF STACK CROSS SECTION



RUN NUMBER  
 DATE  
 PLANT  
 BASE  
 SAMPLE BOX NUMBER  
 METER BOX NUMBER  
 OPERATOR

2  
 3  
 4  
 1

2.07  
 11.5388

## EQUATIONS

$$Q_R = 0.7 \sqrt{1 + 460}$$

$$H = \left[ \frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m \cdot V_p}{T_s}$$

Probed at 18 m Hg  
 Probed at 18 m Hg

AMBIENT TEMP  
 STATION PRESS  
 HEATER BOX TEMP  
 PROBE HEATER SETTING  
 PROBE LENGTH  
 NOZZLE AREA (A)  
 Cp  
 DRY GAS FRACTION (Fd)

| TRAVERSE POINT NUMBER | SAMPLING TIME (min) | STATIC PRESSURE (in H <sub>2</sub> O) | STACK TEMP             |                        | VELOCITY HEAD (Vp) | ORIFICE DIFF. PRESS. (H) | GAS SAMPLE VOLUME (cu ft)  | GAS METER TEMP         |                            |          | SAMPLE BOX TEMP (°F) | IMPINGER OUTLET TEMP (°F) |
|-----------------------|---------------------|---------------------------------------|------------------------|------------------------|--------------------|--------------------------|----------------------------|------------------------|----------------------------|----------|----------------------|---------------------------|
|                       |                     |                                       | (°F)                   | (T <sub>s</sub> ) (°R) |                    |                          |                            | IN (°F)                | AVG (T <sub>m</sub> ) (°R) | OUT (°F) |                      |                           |
| A 1                   | 5                   | -3.0                                  | 500                    |                        | 135                | 2.0                      | 745.475                    | 124                    |                            | 124      | 253                  | 76                        |
| 2                     | 5                   | -3.5                                  | 556                    |                        | 135                | 2.0                      |                            | 127                    |                            | 127      | 260                  | 73                        |
| 3                     | 15                  | -3.5                                  | 637                    |                        | 135                | 2.0                      |                            | 129                    |                            | 125      | 263                  | 71                        |
| 4                     | 15                  | -3.5                                  | 633                    |                        | 135                | 2.0                      | 758.756                    | 129                    |                            | 126      | 265                  | 72                        |
| B 1                   | 0                   | -3.5                                  | 515                    |                        | 135                | 2.0                      | 758.756                    | 130                    |                            | 126      | 267                  | 75                        |
| 2                     | 5                   | -3.5                                  | 546                    |                        | 135                | 2.0                      |                            | 132                    |                            | 129      | 261                  | 73                        |
| 3                     | 10                  | -3.5                                  | 615                    |                        | 135                | 2.0                      |                            | 133                    |                            | 128      | 254                  | 75                        |
| 4                     | 15                  | -3.5                                  | 634                    |                        | 135                | 2.0                      | 772.562                    | 136                    |                            | 136      | 255                  | 76                        |
|                       |                     |                                       | T <sub>s</sub> = 578.9 |                        | AVG = 135          | 64.2.0                   |                            | T <sub>m</sub> = 128.2 |                            |          |                      |                           |
|                       |                     |                                       |                        |                        |                    |                          | TOTAL CORRECT = 27.084     |                        |                            |          |                      |                           |
|                       |                     |                                       |                        |                        |                    |                          | SAMPLING RATE = 0.677 DCFM |                        |                            |          |                      |                           |

**PRELIMINARY SURVEY DATA SHEET NO. 2**  
(Velocity and Temperature Traverse)

**BASE**

Shaw

DATE \_\_\_\_\_

10 Aug 88

BOILER NUMBER

BOILER ~~two~~ Bldg 403

INSIDE STACK DIAMETER

ER  
12.25

Inches

STATION PRESSURE

29.86¢

In Hg

STACK STATIC PRESSURE

- 58

In H<sub>2</sub>O

**SAMPLING TEAM**

| TRAVERSE POINT NUMBER | VELOCITY HEAD, V <sub>p</sub> IN H <sub>2</sub> O | L <del>H<sub>s</sub></del> CYCLONIC | STACK TEMPERATURE (°F) |
|-----------------------|---|-------------------------------------|------------------------|
| 1                     | .11   | 5                                   | 608                    |
| 2                     | .16   | 5                                   | 616                    |
| 3                     | .19   | 5                                   | 638                    |
| 4                     | .15   | 5                                   | 643                    |
|                       |   | AVG = 3.75°                         |                        |
|                       | FPS = 32  |                                     |                        |
|                       | FPM = 1892  |                                     |                        |
|                       | T <sub>S</sub> = 624                              |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
|                       |   |                                     |                        |
| AVERAGE               |   |                                     |                        |

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|  |   |  |
|--|---|--|
| BASE<br><div style="font-size: 1.2em; font-family: cursive;">Shaw</div>                | DATE<br><div style="font-size: 1.2em; font-family: cursive;">10 Aug</div> | RUN NUMBER<br><div style="font-size: 1.2em; font-family: cursive;">Boiler #2</div> |
| BUILDING NUMBER<br><div style="font-size: 1.2em; font-family: cursive;">Bldg 403</div> |   | SOURCE NUMBER  |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (if needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)                | 313.8                | 200                    | 113.8                |
| IMPINGER 2 (H2O)                | 180                  | 200                    | -20.0                |
| IMPINGER 3 (Dry)                |                      |                        |                      |
| IMPINGER 4 (Silica Gel)         | 206.7                | 200                    | 6.7                  |
| Total Weight of Water Collected |                      |                        | 100.5 gm             |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> | 6.8           | 7.0           | 6.9           |               | 6.9     |
| VOL % O <sub>2</sub>  | 8.0           | 7.8           | 7.9           |               | 7.9     |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

Bulver #3

# PARTICULATE SAMPLING DATA SHEET

[illegible]

(Velocity and Temperature Traverse)

30.0

**BASE**

DATE \_\_\_\_\_

SHAW AFB

10 AUG-88

BOILER NUMBER

#3 BLDG 403

INSIDE STACK DIAMETER

12.25"

Inches

STATION PRESSURE

29,860

In Hg

STACK STATIC PRESSURE

-408

In H<sub>2</sub>O

**SAMPLING TEAM**

OFFAL

CYCLONIC  $\sqrt{V_a}$

(Stack Geometry)

Inches

Inches

POINT

PERCENT OF  
DIAMETER

DISTANCE FROM  
INSIDE WALL  
(Inches)

TOTAL DISTANCE FROM OUTSIDE  
OF NIPPLE TO SAMPLING POINT  
(Inches)

/

0.8

4.1

2

3. ~~1~~

6.3

3

9.2

12.4

4

11.4

14.7

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|   |  |   |
|---|--|---|
| BASE<br><div style="font-size: 1.5em; font-family: cursive;">Shaw</div> | DATE<br><div style="font-size: 1.5em; font-family: cursive;">10 Aug 88</div> | RUN NUMBER<br><div style="font-size: 1.5em; font-family: cursive;">Boiler # 3</div> |
|---|--|---|

|  |               |
|--|---------------|
| BUILDING NUMBER<br><div style="font-size: 1.5em; font-family: cursive;">Bldg 403</div> | SOURCE NUMBER |
|--|---------------|

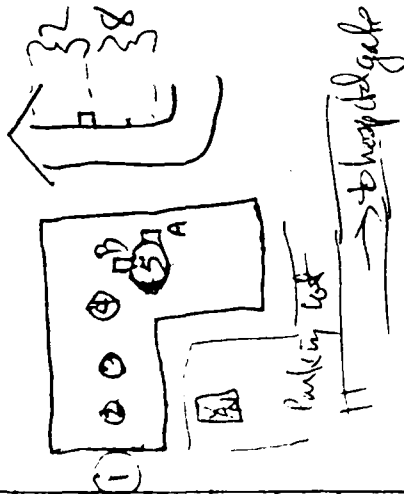
| I. PARTICULATES                             |  |                        |                          |
|---|--|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm)                   | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |  |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |  |                        |                          |
| BACK HALF (If needed)                       |  |                        |                          |
|   | Total Weight of Particulates Collected |                        | gm                       |

| II. WATER               |                                 |                        |                      |
|-------------------------|---------------------------------|------------------------|----------------------|
| ITEM                    | FINAL WEIGHT<br>(gm)            | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)        | 196                             | 200                    | -4.0                 |
| IMPINGER 2 (H2O)        | 292                             | 200                    | 92.0                 |
| IMPINGER 3 (Dry)        |                                 |                        |                      |
| IMPINGER 4 (Silica Gel) | 206.2                           | 200                    | 6.2                  |
|                         | Total Weight of Water Collected |                        | 94.2 gm              |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> | 8.1           | 8.0           | 8.0           |               | 8.0     |
| VOL % O <sub>2</sub>  | 7.2           | 7.2           | 7.1           |               | 7.2     |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

|                              |                                      |  |
|------------------------------|--------------------------------------|--|
| RUN NUMBER<br>Boiler # 5     | SCHEMATIC OF STACK CROSS SECTION<br> | EQUATIONS<br>$^{\circ}R = ^{\circ}F + 460$ $H = \left[ \frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$ <p>Pre leak check &amp; 15 in/sy good</p> <p>Post leak check</p> <p><math>\bar{T}_S = 333.8^{\circ}F</math></p> <p><math>\bar{T}_m = 120.7^{\circ}F</math></p> <p><math>A/H = 1.4</math></p> <p><math>PSTS = 10.3136</math></p> |
| DATE<br>19 Aug 88            |                                      | AMBIENT TEMP<br>102  |
| PLANT<br>Bldg 403            |                                      | STATION PRESS<br>29.605  |
| BASE<br>Shovel               |                                      | HEATER BOX TEMP<br>(blank)   |
| SAMPLE BOX NUMBER<br>(blank) |                                      | PROBE HEATER SETTING<br>(blank)  |
| METER BOX NUMBER<br>(blank)  |                                      | PROBE LENGTH<br>48   |
| Qw/Qm<br>(blank)             |                                      | NOZZLE AREA (A)<br>.51   |
| Co<br>(blank)                |                                      | Cp<br>.84  |
|                              |                                      | DRY GAS FRACTION (Fd)<br>(blank)   |



| TRAVERSE<br>POINT<br>NUMBER | SAMPLING<br>TIME<br>(min) | STATIC<br>PRESSURE<br>(in. H <sub>2</sub> O) | STACK TEMP |              | VELOCITY<br>HEAD<br>(Vp) | ORIFICE<br>DIFF.<br>PRESS.<br>(in) | GAS<br>SAMPLE<br>VOLUME<br>(cu ft) | GAS METER TEMP |                     |             | SAMPLE<br>BOX<br>TEMP<br>(°F) | IMPIPING<br>OUTLET<br>TEMP<br>(°F) |
|-----------------------------|---------------------------|--|------------|--------------|--------------------------|------------------------------------|------------------------------------|----------------|---------------------|-------------|-------------------------------|------------------------------------|
|                             |                           |  | (°F)       | (Ts)<br>(°R) |                          |                                    |                                    | IN<br>(°F)     | AVG<br>(Tm)<br>(°R) | OUT<br>(°F) |                               |                                    |
| A                           | 0                         | -4.5   | 317        |              | .175                     | 1.4                                | 61.464                             | 115            |                     | 114         | 250                           | 72                                 |
|                             | 5                         | -5.0   | 353        |              | .175                     | 1.4                                |                                    | 118            |                     | 114         | 250                           | 72                                 |
|                             | 10                        | -5.0   | 342        |              | .145                     | 1.4                                |                                    | 121            |                     | 115         | 253                           | 71                                 |
|                             | 15                        | -5.0   | 340        |              | .150                     | 1.4                                | 72.920                             | 124            |                     | 117         | 249                           | 68                                 |
| B                           | 0                         | -5.0   | 300        |              | .070                     | 1.4                                |                                    | 129            |                     | 119         | 248                           | 68                                 |
|                             | 5                         | -5.0   | 337        |              | .080                     | 1.4                                |                                    | 127            |                     | 121         | 249                           | 68                                 |
|                             | 10                        | -5.0   | 341        |              | .140                     | 1.4                                |                                    | 128            |                     | 121         | 246                           | 68                                 |
|                             | 15                        | -5.0   | 340        |              | .160                     | 1.4                                | 84.455                             | 131            |                     | 122         | 246                           | 70                                 |
|                             |                           |  |            |              |                          | TOTAL                              | 93 = 22.991                        |                |                     |             |                               |                                    |



(Stack Geometry)

|  |                  |  |                           |                       |  |
|--|------------------|--|---------------------------|-----------------------|--|
| BASE   | Shaw             |  | PLANT                     | Healy Shop (Bldg 403) |  |
| DATE   | 19 Aug 88        |  | SAMPLING TEAM             |                       |  |
| SOURCE TYPE AND MAKE                               | Hot Water Boiler |  | Bldg 403                  |                       |  |
| SOURCE NUMBER                                      | Boiler #5        |  | INSIDE STACK DIAMETER     | 15.75                 |  |
| RELATED CAPACITY                                   |                  |  | TYPE FUEL                 | Gas                   |  |
| DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER | 19.0 (3.25)      |  |                           |                       |  |
| NUMBER OF TRAVERSES                                |                  |  | NUMBER OF POINTS/TRAVERSE |                       |  |

### LOCATION OF SAMPLING POINTS ALONG TRAVERSE

[illegible]

(Velocity and Temperature Traverse)

DATE \_\_\_\_\_

BOILER NUMBER

INSIDE STACK DIAMETER

STATION PRESSURE

Inches

STACK STATIC PRESSURE

In Hg

In H<sub>2</sub>O

**SAMPLING TEAM**

[illegible]

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|                         |                          |                                |
|-------------------------|--------------------------|--------------------------------|
| BASE<br><i>Shaw AFB</i> | DATE<br><i>19 Aug 88</i> | RUN NUMBER<br><i>Bouler #5</i> |
|-------------------------|--------------------------|--------------------------------|

|   |                                  |
|---|----------------------------------|
| BUILDING NUMBER<br><i>Steam-gas-fired</i> | SOURCE NUMBER<br><i>Bldg 403</i> |
|---|----------------------------------|

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (If needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H <sub>2</sub> O)   | 267.0                | 200                    | 67.0                 |
| IMPINGER 2 (H <sub>2</sub> O)   | 212.0                | 200                    | 12.0                 |
| IMPINGER 3 (D <sub>2</sub> O)   | 0.4                  | 0                      | .4                   |
| IMPINGER 4 (Silica Gel)         | 208.0                | 200                    | 8.0                  |
| Total Weight of Water Collected |                      |                        | 87.4 gm              |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

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## **APPENDIX E**

### **Building 611, Steam Boiler Field Data**

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# PARTICULATE SAMPLING DATA SHEET

| SCHEMATIC OF STACK CROSS SECTION |                     |                                       |                 | EQUATIONS          |                           |                           |                     | TEMPERATURES         |                           |  |  |
|----------------------------------|---------------------|---------------------------------------|-----------------|--------------------|---------------------------|---------------------------|---------------------|----------------------|---------------------------|--|--|
| TRaverse POINT NUMBER            | SAMPLING TIME (min) | STATIC PRESSURE (in H <sub>2</sub> O) | STACK TEMP (°F) | VELOCITY HEAD (Vp) | ORIFICE DIFF. PRESS. (in) | GAS SAMPLE VOLUME (cu ft) | GAS METER TEMP (°F) | SAMPLE BOX TEMP (°F) | IMPINGER OUTLET TEMP (°F) |  |  |
| 1                                | 0                   | -3.0                                  | 333             | .135               | 1.4                       | 386.00                    | 84                  | 241                  | 72                        |  |  |
| 2                                | 2.5                 | -3.0                                  | 404             | .156               | 1.4                       |                           | 84                  | 241                  | 68                        |  |  |
| 3                                | 5.0                 | -3.0                                  | 424             | .156               | 1.4                       |                           | 84                  | 243                  | 67                        |  |  |
| 4                                | 7.5                 | -3.0                                  | 424             | .156               | 1.4                       |                           | 84                  | 243                  | 66                        |  |  |
| 5                                | 10.0                | -3.0                                  | 421             | .156               | 1.4                       |                           | 84                  | 243                  | 66                        |  |  |
| 6                                | 12.5                | -3.0                                  | 434             | .156               | 1.4                       |                           | 84                  | 245                  | 67                        |  |  |
| 7                                | 15.0                | -3.0                                  | 423             | .156               | 1.4                       |                           | 84                  | 245                  | 67                        |  |  |
| 8                                | 17.5                | -3.0                                  | 424             | .156               | 1.4                       | 50.015                    | 84                  | 245                  | 67                        |  |  |
| 1                                | 0                   | -3.0                                  | 317             | .115               | 1.4                       |                           | 100                 | 247                  | 72                        |  |  |
| 2                                | 2.5                 | -3.0                                  | 387             | .136               | 1.4                       |                           | 101                 | 247                  | 69                        |  |  |
| 3                                | 5.0                 | -3.0                                  | 411             | .170               | 1.4                       |                           | 103                 | 251                  | 68                        |  |  |
| 4                                | 7.5                 | -3.0                                  | 426             | .130               | 1.4                       |                           | 104                 | 250                  | 68                        |  |  |
| 5                                | 10.0                | -3.0                                  | 421             | .130               | 1.4                       |                           | 104                 | 250                  | 68                        |  |  |
| 6                                | 12.5                | -3.0                                  | 428             | .130               | 1.4                       |                           | 107                 | 249                  | 68                        |  |  |
| 7                                | 15.0                | -3.0                                  | 433             | .130               | 1.4                       |                           | 109                 | 249                  | 68                        |  |  |
| 8                                | 17.5                | -3.0                                  | 438             | .130               | 1.4                       | 60.898                    | 109                 | 250                  | 68                        |  |  |
|                                  |                     |                                       |                 | TOTAL SA = 22.298  |                           |                           |                     |                      |                           |  |  |

DATE: 19 Aug 88

PLANT: Bldg 611

CASE: Show AFB

SAMPLE BOX NUMBER

METER BOX NUMBER

Q<sub>w</sub>/Q<sub>m</sub>

C<sub>o</sub>

$$H \approx \left[ \frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$$

Pre leak check good at 15 min

$$\bar{T}_s = 409.1^\circ F$$

$$\bar{T}_m = 95.6^\circ F$$

$$\bar{\Delta T} = 1.4$$

$$PSIS = 10.2839$$

[illegible]



(Velocity and Temperature Traverse)

**BASE**

Shaw

DATE \_\_\_\_\_

19 Aug 88

BOILER NUMBER

Bldg 611  
METER

INSIDE STACK DIAMETER

Inches

STATION PRESSURE

In Hg

STACK STATIC PRESSURE

— .035

In H<sub>2</sub>O

SAMPLING TEAM

| TRAVERSE POINT NUMBER | VELOCITY HEAD, $V_p$ IN H <sub>2</sub> O | $\alpha$ | STACK TEMPERATURE ( $^{\circ}$ F) |
|-----------------------|--|----------|-----------------------------------|
| 1                     |  | $2\phi$  |                                   |
| 2                     |  | $2\phi$  |                                   |
| 3                     |  | $2\phi$  |                                   |
| 4                     |  | $2\phi$  |                                   |
| 5                     |  | $2\phi$  |                                   |
| 6                     |  | $2\phi$  |                                   |
| 7                     |  | $2\phi$  |                                   |
| 8                     |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
|                       |  |          |                                   |
| AVERAGE               |  |          |                                   |

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|                               |  |  |  |            |  |
|-------------------------------|--|--|--|------------|--|
| BASE<br><i>Shaw AFB</i>       |  | DATE<br><i>19 Aug 80</i>                       |  | RUN NUMBER |  |
| BUILDING NUMBER<br><i>611</i> |  | SOURCE NUMBER<br><i>oil-fired steam boiler</i> |  |            |  |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (if needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H <sub>2</sub> O)   | <i>249.5</i>         | <i>200</i>             | <i>49.5</i>          |
| IMPINGER 2 (H <sub>2</sub> O)   | <i>204.5</i>         | <i>200</i>             | <i>4.5</i>           |
| IMPINGER 3 (Dry)                | <i>1.0</i>           | <i>0</i>               | <i>1.0</i>           |
| IMPINGER 4 (Silica Gel)         | <i>206.2</i>         | <i>200</i>             | <i>6.2</i>           |
| Total Weight of Water Collected |                      |                        | <i>61.2 gm</i>       |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

## **APPENDIX F**

### **Building 922, Hot Water and Steam Boiler Field Data**

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13-05-922

OEHL FORM 18  
MAY 78

## PRELIMINARY SURVEY DATA SHEET NO. 1

### (Stack Geometry)

(Stack Geometry)

[illegible]

(Velocity and Temperature Traverse)

**BASE**

DATE \_\_\_\_\_

Shaw

22 Ave.

BOILER NUMBER

Offices Used: Hot Water Heater

INSIDE STACK DIAMETER

S.C

Inches

STATION PRESSURE

29.815

In Hg

STACK STATIC PRESSURE

- .005

In H2O

**SAMPLING TEAM**

[illegible]

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|   |  |  |                          |               |         |
|---|--|--|--------------------------|---------------|---------|
| BASE<br><i>Shaw</i>   | DATE<br><i>22 April 88</i>             | RUN NUMBER                               |                          |               |         |
| BUILDING NUMBER<br><i>922 (Office Club)</i>                                 |  | SOURCE NUMBER<br><i>Hot Water Heater</i> |                          |               |         |
| <b>I. PARTICULATES</b>  |  |  |                          |               |         |
| ITEM  | FINAL WEIGHT<br>(gm)                   | INITIAL WEIGHT<br>(gm)                   | WEIGHT PARTICLES<br>(gm) |               |         |
| FILTER NUMBER   |  |  |                          |               |         |
| ACETONE WASHINGS (Probe, Front Half Filter)                                 |  |  |                          |               |         |
| BACK HALF (if needed)   |  |  |                          |               |         |
|   | Total Weight of Particulates Collected |  | gm                       |               |         |
| <b>II. WATER</b>  |  |  |                          |               |         |
| ITEM  | FINAL WEIGHT<br>(gm)                   | INITIAL WEIGHT<br>(gm)                   | WEIGHT WATER<br>(gm)     |               |         |
| IMPINGER 1 (H <sub>2</sub> O)   | 226.0                                  | 200.0                                    | 26.0                     |               |         |
| IMPINGER 2 (H <sub>2</sub> O)   | 206.2                                  | 200.0                                    | 6.2                      |               |         |
| IMPINGER 3 (Dry)  | Ø                                      | Ø  | Ø                        |               |         |
| IMPINGER 4 (Silica Gel)   | 207.5                                  | 200.0                                    | 7.5                      |               |         |
|   | Total Weight of Water Collected        |  | 39.7 gm                  |               |         |
| <b>III. GASES (Dry)</b>   |  |  |                          |               |         |
| ITEM  | ANALYSIS<br>1                          | ANALYSIS<br>2                            | ANALYSIS<br>3            | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub>   |  |  |                          |               |         |
| VOL % O <sub>2</sub>  |  |  |                          |               |         |
| VOL % CO  |  |  |                          |               |         |
| VOL % N <sub>2</sub>  |  |  |                          |               |         |
| Vol % N <sub>2</sub> = (100% - % CO <sub>2</sub> - % O <sub>2</sub> - % CO) |  |  |                          |               |         |



# PARTICULATE SAMPLING DATA SHEET

| SCHEMATIC OF STACK CROSS SECTION   |                     |                                       |                 | EQUATIONS  |                           |         |                            | GAS METER TEMP |               |                  |  | SAMPLE |  | IMPINGER |
|--|---------------------|---------------------------------------|-----------------|--|---------------------------|---------|----------------------------|----------------|---------------|------------------|--|--------|--|----------|
| TRAVERSE POINT NUMBER  | SAMPLING TIME (min) | STATIC PRESSURE (in H <sub>2</sub> O) | STACK TEMP (°F) | ORIFICE DIFF. PRESS. (in)  | GAS SAMPLE VOLUME (cu ft) | IN (°F) | AVG (T <sub>m</sub> ) (°R) | OUT (°F)       | BOX TEMP (°F) | OUTLET TEMP (°F) |  |        |  |          |
| <p>13426 422</p> <p>Officers Club</p> <p>18 Aug 83 STEAM</p> <p>gas: fuel heat</p> <p>base Shaw ATP</p> <p>SAMPLE BOX NUMBER</p> <p>METER BOX NUMBER</p> <p>Q<sub>w</sub>/Q<sub>m</sub></p> <p>C<sub>p</sub></p> <p>Dry Gas Fraction (F<sub>d</sub>)</p> |                     |                                       |                 |  |                           |         |                            |                |               |                  |  |        | <p>AMBIENT TEMP 89 °F</p> <p>STATION PRESS 29.635 in Hg</p> <p>HEATER BOX TEMP °F</p> <p>PROBE HEATER SETTING °F</p> <p>PROBE LENGTH 49.342 in</p> <p>NOZZLE AREA (A) 51 sq ft</p> |          |
| <p>Pre leak check at 15 in good</p> <p>Post leak check at 5 in by good</p>   |                     |                                       |                 | <p>°R = °F + 460</p> <p><math>H = \left[ \frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p</math></p> |                           |         |                            |                |               |                  |  |        |  |          |
| A 1  | 0                   | -2.5                                  | 261             | 1.4  | 992.000                   | 88      | 88                         | 87             | 229           | 68               |  |        |  |          |
| 3  | 5                   | -2.5                                  | 293             | 1.4  |                           | 92      |                            | 83             | 241           | 72               |  |        |  |          |
| 3  | 10                  | -3.0                                  | 331             | 1.4  |                           | 94      |                            | 90             | 242           | 69               |  |        |  |          |
| 4  | 15                  | -3.0                                  | 340             | 1.4  | 1003.640                  | 97      |                            | 91             | 242           | 23               |  |        |  |          |
| B 1  | 0                   | -3.0                                  | 206             | 1.4  |                           | 98      |                            | 96             | 243           | 73               |  |        |  |          |
| 2  | 5                   | -3.0                                  | 276             | 1.4  |                           | 102     |                            | 97             | 242           | 71               |  |        |  |          |
| 3  | 10                  | -3.0                                  | 323             | 1.4  |                           | 105     |                            | 98             | 243           | 68               |  |        |  |          |
| 4  | 15                  | -3.0                                  | 334             | 1.4  | 1015.244                  | 107     |                            | 100            | 241           | 68               |  |        |  |          |
| <p>TOTAL CUBIC FT = 23.444</p>   |                     |                                       |                 |  |                           |         |                            |                |               |                  |  |        |  |          |

**PRELIMINARY SURVEY DATA SHEET NO. 1**  
(Stack Geometry)

|   |   |
|---|---|
| BASE<br>Shaw AFB  | PLANT<br>Officers Club                  |
| DATE<br>18 Aug 88   | SAMPLING TEAM                           |
| SOURCE TYPE AND NAME<br>gas <del>at fuel</del>                  | STREAM<br>hot water & heat              |
| SOURCE NUMBER   | INSIDE STACK DIAMETER<br>9.75<br>Inches |
| RELATED CAPACITY  | TYPE FUEL<br><del>gas</del> gas         |
| DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER<br>13 $\phi$ | (3.25)<br>Inches                        |
| NUMBER OF TRAVERSES<br>2  | NUMBER OF POINTS TRAVERSE<br>4          |

### LOCATION OF SAMPLING POINTS ALONG TRAVERSE

[illegible]

(Velocity and Temperature Traverse)

Shaw AFB

18 Aug 88

Officers Club

## STEAM BOILER

9.75

Inches

In Hg

-02

In H<sub>2</sub>O

SAMPLING TEAM

**AVERAGE**

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|  |                          |            |
|--|--------------------------|------------|
| BASE<br><b>SHAW AFB</b>  | DATE<br><b>18 Aug 88</b> | RUN NUMBER |
| BUILDING NUMBER<br><b><del>142E</del> STEAM BOILER<br/>Officers Club</b> | SOURCE NUMBER            |            |

| I. PARTICULATES                             |  |                        |                          |
|---|--|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm)                   | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |  |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |  |                        |                          |
| BACK HALF (if needed)                       |  |                        |                          |
|   | Total Weight of Particulates Collected |                        | gm                       |

| II. WATER               |                                 |                        |                      |
|-------------------------|---------------------------------|------------------------|----------------------|
| ITEM                    | FINAL WEIGHT<br>(gm)            | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)        | 304.0                           | 200.0                  | 104.0                |
| IMPINGER 2 (H2O)        | 216.0                           | 200.0                  | 16.0                 |
| IMPINGER 3 (Dry)        | Ø                               | Ø                      | Ø                    |
| IMPINGER 4 (Silica Gel) | 206.2                           | 200.0                  | 6.2                  |
|                         | Total Weight of Water Collected |                        | 126.2 gm             |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

## **APPENDIX G**

### **Building 1046, Hot Water Boiler Field Data**

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34DG-1046

[illegible]

(Stack Geometry)

InchesInches

POINT

PERCENT OF  
DIAMETER

DISTANCE FROM  
INSIDE WALL  
(Inches)

TOTAL DISTANCE FROM OUTSIDE  
OF NIPPLE TO SAMPLING POINT  
(Inches)

1

6.3

2

7.3

3

8.7

4

10.6

5

15.9

6

17-8

7

19.2

4

20.3



(Velocity and Temperature Traverse)

**BASE**

Shaw AFB

DATE \_\_\_\_\_

22 Aug 88

BOILER NUMBER

R NUMBER  
Dental Clinic

INSIDE STACK DIAMETER

15.  $\emptyset$

Inches

STATION PRESSURE

In Hg

STACK STATIC PRESSURE

-055

In H2O

SAMPLING TEAM

| TRAVERSE POINT NUMBER | VELOCITY HEAD, V <sub>p</sub> IN H <sub>2</sub> O | $\sqrt{V_p}$ | STACK TEMPERATURE (°F) |
|-----------------------|---|--------------|------------------------|
| 1                     |   | 5            |                        |
| 2                     |   | 5            |                        |
| 3                     |   | 5            |                        |
| 4                     |   | 10           |                        |
| 5                     |   | 5            |                        |
| 6                     |   | Ø            |                        |
| 7                     |   | Ø            |                        |
| 8                     |   | Ø            |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
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|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
|                       |   |              |                        |
| AVERAGE               |   |              |                        |

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|  |  |                             |  |            |  |
|--|--|-----------------------------|--|------------|--|
| BASE<br><i>Shaw</i>                        |  | DATE<br><i>22 August 88</i> |  | RUN NUMBER |  |
| BUILDING NUMBER<br><i>10 Dental Clinic</i> |  | SOURCE NUMBER               |  |            |  |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (If needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)                | 255.6                | 200.0                  | 55.6                 |
| IMPINGER 2 (H2O)                | 208.0                | 200.0                  | 8.0                  |
| IMPINGER 3 (Dry)                | Ø                    | Ø                      | Ø                    |
| IMPINGER 4 (Silica Gel)         | 207.4                | 200.0                  | 7.4                  |
| Total Weight of Water Collected |                      |                        | 71.0 gm              |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

125716

## **APPENDIX H**

### **Building 1102, Hot Water Boiler Field Data**

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# PARTICULATE SAMPLING DATA SHEET

| SCHEMATIC OF STACK CROSS SECTION   |                     |                                       |                 | EQUATIONS  |                           |                           |                     | AMBIENT TEMP         |                           |    |       |    |
|--|---------------------|---------------------------------------|-----------------|--|---------------------------|---------------------------|---------------------|----------------------|---------------------------|----|-------|----|
| TRaverse POINT NUMBER  | SAMPLING TIME (min) | STATIC PRESSURE (in H <sub>2</sub> O) | STACK TEMP (°F) | VELOCITY HEAD (Vp)   | ORIFICE DIFF. PRESS. (in) | GAS SAMPLE VOLUME (cu ft) | GAS METER TEMP (°F) | SAMPLE BOX TEMP (°F) | IMPINGER OUTLET TEMP (°F) | °F | in Hg | °F |
|  |                     |                                       |                 | $^{\circ}R = ^{\circ}F + 460$ $H = \left[ \frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$ <p>Pre leak check good at 15 in Hg</p> |                           |                           |                     | $80^{\circ}F$        |                           |    |       |    |
| <p>DATE: 23 Aug 88</p> <p>PLANT: Oilfield-water boiler</p> <p>BASE: Shaw ATP</p> |                     |                                       |                 | <p>Pre leak check good at 15 in Hg</p>   |                           |                           |                     | $24.815$             |                           |    |       |    |
| <p>SAMPLE BOX NUMBER</p>   |                     |                                       |                 | <p>PROBE LENGTH</p>  |                           |                           |                     | $48$                 |                           |    |       |    |
| <p>METER BOX NUMBER</p>  |                     |                                       |                 | <p>NOZZLE AREA (A)</p>   |                           |                           |                     | $51$                 |                           |    |       |    |
| <p>Q<sub>w</sub>/Q<sub>m</sub></p>   |                     |                                       |                 | <p>Cp</p>  |                           |                           |                     | $84$                 |                           |    |       |    |
| <p>C<sub>o</sub></p>   |                     |                                       |                 | <p>DRY GAS FRACTION (F<sub>d</sub>)</p>  |                           |                           |                     |                      |                           |    |       |    |
| TRaverse POINT NUMBER  | SAMPLING TIME (min) | STATIC PRESSURE (in H <sub>2</sub> O) | STACK TEMP (°F) | VELOCITY HEAD (Vp)   | ORIFICE DIFF. PRESS. (in) | GAS SAMPLE VOLUME (cu ft) | GAS METER TEMP (°F) | SAMPLE BOX TEMP (°F) | IMPINGER OUTLET TEMP (°F) |    |       |    |
| A 1  | 0                   | -5.0                                  | 194             | .030   | 1.4                       | 133.85                    | 82                  | 238                  | 68                        |    |       |    |
| 2  | 2.5                 | -5.0                                  | 198             | .035   | 1.4                       |                           | 83                  | 239                  | 68                        |    |       |    |
| 3  | 5.0                 | -5.0                                  | 206             | .040   | 1.4                       |                           | 88                  | 241                  | 68                        |    |       |    |
| 4  | 7.5                 | -5.0                                  | 210             | .050   | 1.4                       |                           | 89                  | 244                  | 65                        |    |       |    |
| 5  | 10.0                | -5.0                                  | 216             | .060   | 1.4                       |                           | 89                  | 246                  | 68                        |    |       |    |
| 6  | 12.5                | -5.0                                  | 224             | .050   | 1.4                       |                           | 87                  | 243                  | 68                        |    |       |    |
| 7  | 15.0                | -5.0                                  | 232             | .060   | 1.4                       |                           | 86                  | 247                  | 68                        |    |       |    |
| 8  | 17.5                | -5.0                                  | 238             | .065   | 1.4                       |                           | 89                  | 246                  | 68                        |    |       |    |
| B 1  | 0                   | -5.0                                  | 240             | .040   | 1.4                       |                           | 97                  | 249                  | 68                        |    |       |    |
| 2  | 2.5                 | -5.0                                  | 253             | .050   | 1.4                       |                           | 93                  | 250                  | 68                        |    |       |    |
| 3  | 5.0                 | -5.0                                  | 257             | .052   | 1.4                       |                           | 94                  | 246                  | 68                        |    |       |    |
| 4  | 7.5                 | -5.0                                  | 260             | .055   | 1.4                       |                           | 94                  | 243                  | 68                        |    |       |    |
| 5  | 10.0                | -5.0                                  | 263             | .060   | 1.4                       |                           | 95                  | 247                  | 64                        |    |       |    |
| 6  | 12.5                | -5.0                                  | 265             | .075   | 1.4                       |                           | 95                  | 248                  | 68                        |    |       |    |
| 7  | 15.0                | -5.0                                  | 268             | .070   | 1.4                       |                           | 96                  | 252                  | 68                        |    |       |    |
| 8  | 17.5                | -5.0                                  | 271             | .070   | 1.4                       |                           | 97                  | 253                  | 68                        |    |       |    |
|  |                     |                                       |                 |  |                           | TOTAL                     |                     | 156.427              |                           |    |       |    |
|  |                     |                                       |                 |  |                           | TOTAL                     |                     | 22.576               |                           |    |       |    |

(Stack Geometry)

[illegible]

(Velocity and Temperature Traverse)

Shaw AFB

23 ~~AUG~~ 88

BW 1102

9.75

Inches

STATION PRESSURE

In Hg

- 04

In H<sub>2</sub>O

SAMPLING TEAM

**AVERAGE**

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|                                 |  |            |
|---------------------------------|--|------------|
| BASE<br><i>Shaw</i>             | DATE<br><i>23 Aug 88</i>                       | RUN NUMBER |
| BUILDING NUMBER<br><i>#1102</i> | SOURCE NUMBER<br><i>oil-fired water boiler</i> |            |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (if needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H <sub>2</sub> O)   | <i>229.0</i>         | <i>200.0</i>           | <i>29.0</i>          |
| IMPINGER 2 (H <sub>2</sub> O)   | <i>214.0</i>         | <i>200.0</i>           | <i>14.0</i>          |
| IMPINGER 3 (Dry)                | <i>2.0</i>           | <i>∅</i>               | <i>2.0</i>           |
| IMPINGER 4 (Silica Gel)         | <i>209.7</i>         | <i>200</i>             | <i>9.7</i>           |
| Total Weight of Water Collected |                      |                        | <i>54.7 gm</i>       |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$



## **APPENDIX I**

### **Building 1130, Steam Boiler Field Data**

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# PARTICULATE SAMPLING DATA SHEET

| RUN NUMBER            |                     | SCHEMATIC OF STACK CROSS SECTION     |                   | EQUATIONS   |                    | AMBIENT TEMP  |                           |                        |   |          |                      |                           |
|-----------------------|---------------------|--------------------------------------|-------------------|---|--------------------|---|---------------------------|------------------------|---|----------|----------------------|---------------------------|
| DATE                  | PLANT               | BASE                                 | SAMPLE BOX NUMBER | METER BOX NUMBER  | NOTE               | Qw/Qm   | Co                        |                        |   |          |                      |                           |
| 18 Aug 88             | Bldg 1130           | Shed                                 | RBC               |   |                    |   |                           |                        |   |          |                      |                           |
|                       |                     |                                      |                   | $H = \left[ \frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$ |                    | STATION PRESS<br>29.635<br>HEATER BOX TEMP<br>OF<br>PROBE HEATER SETTING<br>OF<br>PROBE LENGTH<br>72<br>NOZZLE AREA (A)<br>51<br>sq ft<br>Cp<br>84<br>DRY GAS FRACTION (Fd) |                           |                        |   |          |                      |                           |
|                       |                     |                                      |                   | $\Delta T = 407.9^\circ F$ $\bar{T}_m = 100.2^\circ F$ $\Delta H = 1.4$ $P_{STS} = 11.3643$         |                    |   |                           |                        |   |          |                      |                           |
|                       |                     |                                      |                   |   |                    |   |                           |                        |   |          |                      |                           |
| TRAVERSE POINT NUMBER | SAMPLING TIME (min) | STACK PRESSURE (in H <sub>2</sub> O) | STACK TEMP (°F)   | STACK TEMP (T <sub>s</sub> ) (°R)   | VELOCITY HEAD (Vp) | ORIFICE DIFF. PRESS. (H)  | GAS SAMPLE VOLUME (cu ft) | GAS METER TEMP IN (°F) | GAS METER TEMP AVG (T <sub>m</sub> ) (°R) | OUT (°F) | SAMPLE BOX TEMP (°F) | IMPINGER OUTLET TEMP (°F) |
| 1                     | 0                   | -3.0                                 | 280               |   | .18                | 1.4   | 15.675                    | 95                     |   | 94       | 238                  | 78                        |
| 2                     | 2.5                 | -3.0                                 | 322               |   | .19                | 1.4   |                           | 95                     |   | 95       | 238                  | 74                        |
| 3                     | 5.0                 | -3.0                                 | 349               |   | .19                | 1.4   |                           | 96                     |   | 95       | 238                  | 68                        |
| 4                     | 7.5                 | -3.0                                 | 441               |   | .18                | 1.4   |                           | 98                     |   | 93       | 241                  | 68                        |
| 5                     | 10.0                | -3.0                                 | 495               |   | .12                | 1.4   |                           | 100                    |   | 96       | 250                  | 68                        |
| 6                     | 12.5                | -3.0                                 | 495               |   | .12                | 1.4   |                           | 102                    |   | 96       | 252                  | 68                        |
| 7                     | 15.0                | -3.0                                 | 496               |   | .12                | 1.4   |                           | 102                    |   | 97       | 254                  | 68                        |
| 8                     | 17.5                | -3.0                                 | 496               |   | .12                | 1.4   | 27.100                    | 104                    |   | 98       | 256                  | 75                        |
| 1                     | 0                   | -3.0                                 | 220               |   | .06                | 1.4   |                           | 102                    |   | 96       | 258                  | 76                        |
| 2                     | 2.5                 | -3.0                                 | 270               |   | .10                | 1.4   |                           | 103                    |   | 98       | 259                  | 74                        |
| 3                     | 5.0                 | -3.0                                 | 327               |   | .10                | 1.4   |                           | 103                    |   | 99       | 258                  | 74                        |
| 4                     | 7.5                 | -3.0                                 | 362               |   | .11                | 1.4   |                           | 107                    |   | 100      | 258                  | 68                        |
| 5                     | 10.0                | -3.0                                 | 484               |   | .17                | 1.4   |                           | 107                    |   | 100      | 258                  | 68                        |
| 6                     | 12.5                | -3.0                                 | 495               |   | .21                | 1.4   |                           | 108                    |   | 101      | 258                  | 68                        |
| 7                     | 15.0                | -3.0                                 | 497               |   | .24                | 1.4   |                           | 109                    |   | 101      | 259                  | 66                        |
| 8                     | 17.5                | -3.0                                 | 498               |   | .23                | 1.4   | 38.301                    | 109                    |   | 102      | 260                  | 72                        |
|                       |                     |                                      |                   |   |                    |   | TOTAL 43 = 22.626         |                        |   |          |                      |                           |

(Stack Geometry)

|  |                                      |
|--|--------------------------------------|
| BASE<br>Shaw AFB                                   | PLANT<br>Bldg 1130                   |
| DATE<br>18 Aug 88                                  | SAMPLING TEAM                        |
| SOURCE TYPE AND MAKE<br>Steam Boiler               |                                      |
| SOURCE NUMBER                                      | INSIDE STACK DIAMETER<br>10.0 Inches |
| RELATED CAPACITY                                   | TYPE FUEL                            |
| DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER |                                      |
| NUMBER OF TRAVERSES<br>2                           | NUMBER OF POINTS/TRAVERSE<br>8       |

[illegible]

(Velocity and Temperature Traverse)

**BASE**

Shaw AEB

DATE \_\_\_\_\_

18 Aug 88

BOILER NUMBER

9th AF HQ Bldg 1130

INSIDE STACK DIAMETER

10.0.2

Inches

STATION PRESSURE

In Hg

STACK STATIC PRESSURE

-16

LC H 20

**SAMPLING TEAM**

[illegible]

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|                                 |                          |            |
|---------------------------------|--------------------------|------------|
| BASE<br><i>Shaw</i>             | DATE<br><i>18 Aug 88</i> | RUN NUMBER |
| BUILDING NUMBER<br><i>#1130</i> | SOURCE NUMBER            |            |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (If needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)                | <i>238.0</i>         | <i>200.0</i>           | <i>38.0</i>          |
| IMPINGER 2 (H2O)                | <i>204.0</i>         | <i>200.0</i>           | <i>4.0</i>           |
| IMPINGER 3 (Dry)                |                      |                        |                      |
| IMPINGER 4 (Silica Gel)         | <i>206.1</i>         | <i>200</i>             | <i>6.1</i>           |
| Total Weight of Water Collected |                      |                        | <i>48.1</i> gm       |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

## **APPENDIX J**

### **Building 1200, Steam Boilers 1, 2 and 3 Field Data**

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# PARTICULATE SAMPLING DATA SHEET

| SCHEMATIC OF STACK CROSS SECTION  |                     |   |                 | EQUATIONS  |                           |                           |                        | AMBIENT TEMP  |                      |                           |  |
|---|---------------------|---|-----------------|--|---------------------------|---------------------------|------------------------|---|----------------------|---------------------------|--|
| TRaverse POINT NUMBER   | SAMPLING TIME (min) | STATIC PRESSURE (in H <sub>2</sub> O) $\frac{1}{2}$ | STACK TEMP (°F) | STACK TEMP (°R)  | ORIFICE DIFF. PRESS. (in) | GAS SAMPLE VOLUME (cu ft) | GAS METER TEMP IN (°F) | GAS METER TEMP OUT (°F)   | SAMPLE BOX TEMP (°F) | IMPINGER OUTLET TEMP (°F) |  |
| <p>oil fired</p> <p> <math>T_s = 369.1</math><br/> <math>T_m = 89.4</math><br/> <math>\Delta H = 1.37</math><br/> <math>PSIS = 9.1134</math> </p> |                     |   |                 | $OR = °F + 460$<br>$H = \left[ \frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$ |                           |                           |                        | <p>29</p> <p>STATION PRESS 29.945</p> <p>HEATER BOX TEMP</p> <p>PROBE HEATER SETTING</p> <p>PROBE LENGTH 72</p> <p>NOZZLE AREA .51</p> <p>Cp .84</p> <p>DRY GAS FRACTION (Fd)</p> |                      |                           |  |
| A1  | 0                   | 2.0   | 173             |  | .85                       | 797.954                   | 78                     | 78  | 232                  | 68                        |  |
| A2  | 3                   | 2.0   | 345             |  | .90                       |                           | 80                     | 78  | 232                  | 68                        |  |
| A3  | 6                   | 2.0   | 390             |  | 1.20                      |                           | 85                     | 81  | 237                  | 65                        |  |
| A4  | 9                   | 2.0   | 421             |  | 1.7                       |                           | 86                     | 83  | 238                  | 65                        |  |
| A5  | 17                  | 2.5   | 441             |  | 1.9                       |                           | 90                     | 85  | 247                  | 66                        |  |
| A6  | 15                  | 2.5   | 441             |  | 1.8                       |                           | 93                     | 86  | 247                  | 68                        |  |
| A7  | 18                  | 2.5   | 441             |  | 1.7                       |                           | 95                     | 87  | 241                  | 68                        |  |
| A8  | 21                  | 2.5   | 438             |  | 1.6                       | 812.412                   | 96                     | 92  |                      |                           |  |
| B1  | 0                   | 2.0   | 170             |  | .70                       |                           | 97                     | 87  | 239                  | 75                        |  |
| B2  | 3                   | 2.0   | 200             |  | .80                       |                           | 94                     | 89  | 238                  | 75                        |  |
| B3  | 6                   | 2.0   | 338             |  | 1.0                       |                           | 96                     | 89  | 238                  | 72                        |  |
| B4  | 9                   | 2.0   | 407             |  | 1.6                       |                           | 97                     | 90  | 238                  | 72                        |  |
| B5  | 12                  | 2.3   | 435             |  | 1.7                       |                           | 98                     | 91  | 238                  | 72                        |  |
| B6  | 13                  | 2.5   | 437             |  | 1.7                       |                           | 100                    | 92  | 238                  | 72                        |  |
| B7  | 18                  | 2.5   | 436             |  | 1.4                       |                           | 101                    | 92  | 238                  | 72                        |  |
| B8  | 21                  | 2.5   | 436             |  | 1.2                       | 874.878                   | 101                    | 92  | 238                  | 72                        |  |
| <p>FINAL SF3 = 27.079</p> <p>26.928</p>   |                     |   |                 |  |                           |                           |                        |   |                      |                           |  |

(Velocity and Temperature Traverse)

**BASE**

Shaw

DATE \_\_\_\_\_

12 Aug 88

BOILER NUMBER

~~XXXXXXXXXX~~ 1

BLDG 1200

INSIDE STACK DIAMETER

9.63

Inches

STATION PRESSURE

29.945

In Hg

STACK STATIC PRESSURE

-045

In H<sub>2</sub>O

**SAMPLING TEAM**

[illegible]

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|                                     |                          |                                    |
|-------------------------------------|--------------------------|------------------------------------|
| BASE<br><b>SITAW AFB</b>            | DATE<br><b>12 AUG 88</b> | RUN NUMBER<br><b>1</b>             |
| BUILDING NUMBER<br><b>BLDG 1200</b> |                          | SOURCE NUMBER<br><b>BOILER # 1</b> |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (if needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

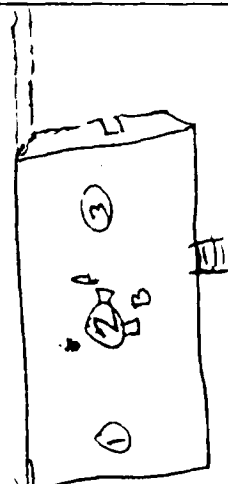
| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)                | 246.0                | 200                    | 46.0                 |
| IMPINGER 2 (H2O)                | 206.0                | 200                    | 6.0                  |
| IMPINGER 3 (Dry)                | 1.1                  | 0                      | 1.1                  |
| IMPINGER 4 (Silica Gel)         | 205.8                | 200                    | 5.8                  |
| Total Weight of Water Collected |                      |                        | 58.9 gm              |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> | 6.8           | 6.8           | 6.8           |               | 6.8     |
| VOL % O <sub>2</sub>  | 11.4          | 11.4          | 11.4          |               | 11.4    |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

# PARTICULATE SAMPLING DATA SHEET

| SCHEMATIC OF STACK CROSS SECTION |                     |                         |                 | EQUATIONS  |                          |                           |                | AMBIENT TEMP              |               |                 |                      |
|----------------------------------|---------------------|-------------------------|-----------------|--|--------------------------|---------------------------|----------------|---------------------------|---------------|-----------------|----------------------|
| RUN NUMBER                       | DATE                | PLANT                   | BASE            | $H = \left[ \frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_{in} \cdot V_p}{T_s}$ | ORIFICE DIFF. PRESS. (H) | GAS SAMPLE VOLUME (cu ft) | GAS METER TEMP | IMPINGER OUTLET TEMP (°F) | STATION PRESS | HEATER BOX TEMP | PROBE HEATER SETTING |
| TRaverse POINT NUMBER            | SAMPLING TIME (min) | STATIC PRESSURE (in Hg) | STACK TEMP (°F) | VELOCITY HEAD (Vp)   | ORIFICE DIFF. PRESS. (H) | GAS SAMPLE VOLUME (cu ft) | GAS METER TEMP | IMPINGER OUTLET TEMP (°F) | STATION PRESS | HEATER BOX TEMP | PROBE HEATER SETTING |
|                                  |                     |                         | (°F)            | (Vp)   | (H)                      | (cu ft)                   | IN (°F)        | OUT (°F)                  | STATION PRESS | HEATER BOX TEMP | PROBE HEATER SETTING |
| 1                                | 0                   | 2.0                     | 160             | 0.013  | 1.20                     | 826.340                   | 116            | 114                       | 29.945        | 100             |                      |
| 2                                | 3                   | 2.0                     | 200             | 0.025  | 1.30                     |                           | 116            | 115                       | 29.945        |                 |                      |
| 3                                | 4                   | 2.0                     | 270             | 0.03   | 1.40                     |                           | 116            | 116                       | 29.945        |                 |                      |
| 4                                | 9                   | 2.0                     | 295             | 0.04   | 1.50                     |                           | 116            | 117                       | 29.945        |                 |                      |
| 5                                | 12                  | 2.0                     | 305             | 0.04   | 1.60                     |                           | 122            | 118                       | 29.945        |                 |                      |
| 6                                | 13                  | 2.5                     | 304             | 0.04   | 1.70                     |                           | 122            | 119                       | 29.945        |                 |                      |
| 7                                | 18                  | 2.5                     | 300             | 0.04   | 1.80                     |                           | 123            | 119                       | 29.945        |                 |                      |
| 8                                | 21                  | 2.5                     | 310             | 0.03   | 1.50                     | 838.346                   | 123            | 119                       | 29.945        |                 |                      |
| 1                                | 0                   | 2.0                     | 165             | 0.015  | 1.1                      |                           | 122            | 120                       | 29.945        |                 |                      |
| 2                                | 3                   | 2.0                     | 194             | 0.015  | 1.2                      |                           | 122            | 121                       | 29.945        |                 |                      |
| 3                                | 4                   | 2.0                     | 226             | 0.020  | 1.25                     |                           | 122            | 122                       | 29.945        |                 |                      |
| 4                                | 9                   | 2.5                     | 276             | 0.040  | 1.30                     |                           | 122            | 122                       | 29.945        |                 |                      |
| 5                                | 12                  | 2.5                     | 309             | 0.040  | 1.40                     |                           | 122            | 122                       | 29.945        |                 |                      |
| 6                                | 13                  | 2.5                     | 312             | 0.030  | 1.40                     |                           | 122            | 122                       | 29.945        |                 |                      |
| 7                                | 18                  | 2.5                     | 313             | 0.030  | 1.50                     |                           | 122            | 122                       | 29.945        |                 |                      |
| 8                                | 21                  | 2.5                     | 313             | 0.02   | 1.25                     | 851.712                   | 122            | 122                       | 29.945        |                 |                      |
|                                  |                     |                         |                 | TOTAL FP = 25.322  |                          |                           |                |                           |               |                 |                      |



$\bar{T}_s = 266.12$   
 $\bar{T}_m = 121.4$   
 $AH = 1.57$   
 $PTS = 4.6228$

(Velocity and Temperature Traverse)

**BASE**

Shaw

DATE \_\_\_\_\_

12 Aug 88

BOILER NUMBER

#2

Bldg 1200

INSIDE STACK DIAMETER

$9\frac{5}{8}'' (9.625'')$

Inches

STATION PRESSURE

29.945

In Hg

STACK STATIC PRESSURE

-045

In H<sub>2</sub>O

SAMPLING TEAM

[illegible]

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|                          |                          |                        |
|--------------------------|--------------------------|------------------------|
| BASE<br><i>SITAX AFB</i> | DATE<br><i>12 AUG 88</i> | RUN NUMBER<br><i>1</i> |
|--------------------------|--------------------------|------------------------|

|                                     |                                    |
|-------------------------------------|------------------------------------|
| BUILDING NUMBER<br><i>BLDG 1200</i> | SOURCE NUMBER<br><i>BOILER # 2</i> |
|-------------------------------------|------------------------------------|

| I. PARTICULATES                             |  |                        |                          |
|---|--|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm)                   | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |  |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |  |                        |                          |
| BACK HALF (if needed)                       |  |                        |                          |
|   | Total Weight of Particulates Collected |                        | gm                       |

| II. WATER               |                                 |                        |                      |
|-------------------------|---------------------------------|------------------------|----------------------|
| ITEM                    | FINAL WEIGHT<br>(gm)            | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)        | <i>262</i>                      | <i>200</i>             | <i>62.0</i>          |
| IMPINGER 2 (H2O)        | <i>206</i>                      | <i>200</i>             | <i>6.0</i>           |
| IMPINGER 3 (Dry)        | <i>0.5</i>                      | <i>0.0</i>             | <i>0.5</i>           |
| IMPINGER 4 (Silica Gel) | <i>206.5</i>                    | <i>200</i>             | <i>6.5</i>           |
|                         | Total Weight of Water Collected |                        | <i>75.0</i> gm       |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$

# PARTICULATE SAMPLING DATA SHEET

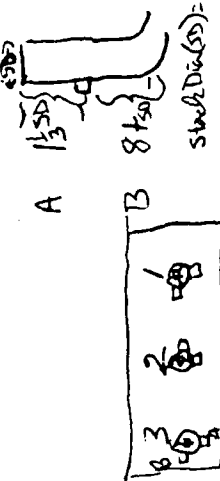
|  |  |                           |  |                                |  |       |  |
|--|--|---------------------------|--|--------------------------------|--|-------|--|
| RUN NUMBER<br><b>Boiler #3 Oil fired</b> |  | AMBIENT TEMP<br><b>84</b> |  | STATION PRESS<br><b>29.929</b> |  | IM Hg |  |
| DATE<br><b>11 Aug 88</b>                 |  | HEATER BOX TEMP           |  | PROBE HEATER SETTING           |  | OF    |  |
| PLANT<br><b>Bldg 1200</b>                |  | PROBE LENGTH<br><b>72</b> |  | NOZZLE AREA (sq ft)            |  | in    |  |
| BASE<br><b>8</b>                         |  | NOZZLE AREA (sq ft)       |  | Cp                             |  | sq ft |  |
| SAMPLE BOX NUMBER                        |  | NOZZLE AREA (sq ft)       |  | Cp                             |  | sq ft |  |
| METER BOX NUMBER                         |  | NOZZLE AREA (sq ft)       |  | Cp                             |  | sq ft |  |
| Qw/Qm                                    |  | NOZZLE AREA (sq ft)       |  | Cp                             |  | sq ft |  |
| Co                                       |  | NOZZLE AREA (sq ft)       |  | Cp                             |  | sq ft |  |

## EQUATIONS

$$OR = OF + 460$$

$$H = \left[ \frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$$

## SCHEMATIC OF STACK CROSS-SECTION



Peak check at 18 in Hg  
 ΔP's OBTAINED WITH DETACHED  
 PARTICULATE.

$T_s = 281.6$   
 $T_m = 107.5$   
 $\Delta H = 1.30$   
 $\Delta P = 0.10$

PTS = 8.1510

| TRAVERSE POINT NUMBER | SAMPLING TIME (min) | STATIC PRESSURE (in H <sub>2</sub> O) | STACK TEMP |                        | VELOCITY HEAD (Vp) | ORIFICE DIFF. PRESS. (H) | GAS SAMPLE VOLUME (cu ft)  | GAS METER TEMP |                            |          | SAMPLE BOX TEMP (°F) | IMPINGER OUTLET TEMP (°F) |
|-----------------------|---------------------|---------------------------------------|------------|------------------------|--------------------|--------------------------|----------------------------|----------------|----------------------------|----------|----------------------|---------------------------|
|                       |                     |                                       | (°F)       | (T <sub>s</sub> ) (°F) |                    |                          |                            | IN (°F)        | AVG (T <sub>m</sub> ) (°F) | OUT (°F) |                      |                           |
| A 1                   | 0                   | 2.5                                   | 180        |                        | 0.08               | 1.1                      | 772.850                    | 99             |                            | 96       | 247                  | 76                        |
| A 2                   | 3                   | 3.0                                   | 200        |                        | 0.11               | 1.5                      |                            | 102            |                            | 98       | 243                  | 67                        |
| A 3                   | 4                   | 3.0                                   | 225        |                        | 0.135              | 1.86                     |                            | 104            |                            | 98       | 244                  | 65                        |
| A 4                   | 4                   | 3.0                                   | 207        |                        | 0.17               | 2.2                      |                            | 108            |                            | 99       | 244                  | 66                        |
| A 5                   | 12                  | 3.0                                   | 346        |                        | 0.18               | 2.3                      |                            | 109            |                            | 100      | 243                  | 67                        |
| A 6                   | 15                  | 3.0                                   | 347        |                        | 0.09               | 1.2                      |                            | 110            |                            | 101      | 244                  | 70                        |
| A 7                   | 18                  | 3.0                                   | 355        |                        | 0.04               | .5                       |                            | 111            |                            | 102      | 244                  | 72                        |
| A 8                   | 21                  | 3.0                                   | 319        |                        | 0.03               | .4                       | 786.125                    | 109            |                            | 105      | 244                  | 83                        |
| B 1                   | 0                   | 2.0                                   | 177        |                        | 0.03               | .4                       |                            | 100            |                            | 106      | 244                  | 83                        |
| B 2                   | 3                   | 2.0                                   | 206        |                        | 0.05               | 1.69                     |                            | 114            |                            | 106      | 244                  | 76                        |
| B 3                   | 6                   | 2.5                                   | 240        |                        | 0.09               | 1.2                      |                            | 111            |                            | 108      | 247                  | 75                        |
| B 4                   | 9                   | 2.5                                   | 287        |                        | 0.14               | 1.9                      |                            | 113            |                            | 109      | 249                  | 77                        |
| B 5                   | 12                  | 2.5                                   | 339        |                        | 0.16               | 2.2                      |                            | 113            |                            | 109      | 249                  | 77                        |
| B 6                   | 15                  | 2.5                                   | 344        |                        | 0.13               | 1.8                      |                            | 118            |                            | 111      | 248                  | 77                        |
| B 7                   | 18                  | 3.0                                   | 351        |                        | 0.08               | 1.1                      |                            | 120            |                            | 113      | 247                  | 77                        |
| B 8                   | 21                  | 3.0                                   | 308        |                        | 0.03               | .4                       | 798.320                    | 120            |                            | 115      | 249                  | 75                        |
|                       |                     |                                       |            |                        |                    |                          | 25.415                     | 113            |                            |          |                      |                           |
|                       |                     |                                       |            |                        |                    |                          | SAMPLING RATE = 0.53 l/cfm |                |                            |          |                      |                           |

(Stack Geometry)

|   |                                       |        |
|---|---------------------------------------|--------|
| BASE<br>Shaw  | PLANT<br>BLDG 1200                    |        |
| DATE<br>11 Aug 88   | SAMPLING TEAM                         |        |
| SOURCE TYPE AND MAKE<br>BLDG 1200                                 | BOILER # 3                            |        |
| SOURCE NUMBER   | INSIDE STACK DIAMETER<br>9 7/8 (9.63) | Inches |
| RELATED CAPACITY  | TYPE FUEL<br>OIL                      |        |
| DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER<br>3 3/8 (3.4) |                                       | Inches |
| NUMBER OF TRAVERSES<br>2  | NUMBER OF POINTS/TRAVERSE<br>8        |        |

### LOCATION OF SAMPLING POINTS ALONG TRAVERSE

[illegible]



(Velocity and Temperature Traverse)

**BASE**

Shaw

DATE \_\_\_\_\_

11 Aug 88

BOILER NUMBER

BER ~~CRX~~ 3

BLOG 1200

INSIDE STACK DIAMETER

95 in

Inches

STATION PRESSURE

29.929

In Hg

STACK STATIC PRESSURE

- .09

In H<sub>2</sub>O

**SAMPLING TEAM**

| TRAVERSE POINT NUMBER | VELOCITY HEAD, V <sub>p</sub> IN H <sub>2</sub> O | L <del>V</del> CYCLONIC | STACK TEMPERATURE (°F) |
|-----------------------|---|-------------------------|------------------------|
| 1                     | .08   | 13                      | 185                    |
| 2                     | .09   | 15                      | 205                    |
| 3                     | .12   | 15                      | 237                    |
| 4                     | .135  | 14                      | 310                    |
| 5                     | .156  | 15                      | 345                    |
| 6                     | .13   | 14                      | 338                    |
| 7                     | .03   | 15                      | 330                    |
| 8                     | .01   | 13                      | 305                    |
|                       |   | AVG = 14.3              |                        |
|                       |   |                         |                        |
|                       |   |                         |                        |
|                       |   |                         |                        |
|                       |   |                         |                        |
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|                       |   |                         |                        |
|                       |   |                         |                        |
|                       |   |                         |                        |
|                       |   |                         |                        |
| AVERAGE               |   |                         |                        |

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|                                |   |                          |
|--------------------------------|---|--------------------------|
| BASE<br><i>Shaw</i>            | DATE<br><i>11 Aug 88</i>                    | RUN NUMBER<br><i>N/C</i> |
| BUILDING NUMBER<br><i>1200</i> | SOURCE NUMBER<br><i>Boiler #3 Oil Fired</i> |                          |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (if needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |   |
|---------------------------------|----------------------|------------------------|---|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm)                      |
| IMPINGER 1 (H2O)                | <i>289.5</i>         | <i>200.0</i>           | <i>89.5</i>                               |
| IMPINGER 2 (H2O)                | <i>169.0</i>         | <i>200.0</i>           | <i>- 31.0</i>                             |
| IMPINGER 3 (Dry)                | <i>1.6</i>           | <i>0</i>               | <i>1.6</i>                                |
| IMPINGER 4 (Silica Gel)         | <i>206.2</i>         | <i>200.0g</i>          | <i>6.2</i>                                |
| Total Weight of Water Collected |                      |                        | <i>66.3</i><br><del><i>128.3</i></del> gm |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

Vol % N<sub>2</sub> = (100% - % CO<sub>2</sub> - % O<sub>2</sub> - % CO)

## **APPENDIX K**

### **Building 1206, Steam Boiler Field Data**

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|                       |        |       |
|-----------------------|--------|-------|
| AMBIENT TEMP          | 62     | of    |
| STATION PRESS         | 29.846 | in Hg |
| HEATER BOX TEMP       |        | of    |
| PROBE HEATER SETTING  |        |       |
| PROBE LENGTH          | 72     | in    |
| NOZZLE AREA           | 13.88  | sq ft |
| Cp                    | 84     |       |
| DRY GAS FRACTION (FD) |        |       |

**EQUATIONS**

$$^{\circ}R = ^{\circ}F + 460$$

$$H = \left[ \frac{5130 \cdot F \cdot d \cdot C \cdot p \cdot A}{Co} \right]^2 \cdot \frac{T_m}{T_s} \cdot Vp$$

Pre-lens check - good. 15 in Hg  
 Post-lens check - good at 7 in Hg

| RUN NUMBER | DATE      | PLANT     | BASE | SAMPLE BOX NUMBER | METER BOX NUMBER | Qw/Qm | Co |
|------------|-----------|-----------|------|-------------------|------------------|-------|----|
|            | 15 Aug 88 | Bldg 1206 | SLD  | RAC               | NUTECH           |       |    |

SCHEMATIC OF STACK CROSS SECTION

one boiler  
oil fired  
B = 238.1  
Tm = 98.25  
ΔH = 1.25  
P3TS = 3.1900

| TRAVERSE<br>POINT<br>NUMBER | SAMPLING<br>TIME<br>(min) | STATIC<br>PRESSURE<br>(in. H <sub>2</sub> O)<br>(in. Hg) | STACK TEMP |      | VELOCITY<br>HEAD<br>(Vp) | ORIFICE<br>DIFF.<br>PRESS.<br>(H) | GAS<br>SAMPLE<br>VOLUME<br>(cu ft) | GAS METER TEMP |                     |             | SAMPLE<br>BOX<br>TEMP<br>(°F) | IMPINGER<br>OUTLET<br>TEMP<br>(°F) |
|-----------------------------|---------------------------|--|------------|------|--------------------------|-----------------------------------|------------------------------------|----------------|---------------------|-------------|-------------------------------|------------------------------------|
|                             |                           |  | (°F)       | (°F) |                          |                                   |                                    | IN<br>(°F)     | AVG<br>(Tm)<br>(°F) | OUT<br>(°F) |                               |                                    |
| A 1                         | 0                         | 3.50   | 101        |      | .01                      | 1.0                               | 851.965                            | 100            |                     | 99          | 234                           | 70                                 |
| 2                           | 3                         | 3.50   | 200        |      | .01                      | 1.0                               |                                    | 101            |                     | 100         | 242                           | 66                                 |
| 3                           | 6                         | 3.5  | 207        |      | .02                      | 1.5                               |                                    | 102            |                     | 100         | 243                           | 64                                 |
| 4                           | 9                         | 4.0  | 238        |      | .02                      | 1.5                               |                                    | 102            |                     | 100         | 246                           | 64                                 |
| 5                           | 12                        | 4.0  | 288        |      | .02                      | 1.5                               |                                    | 104            |                     | 100         | 247                           | 63                                 |
| 6                           | 15                        | 4.0  | 298        |      | .02                      | 1.5                               |                                    | 105            |                     | 101         | 247                           | 66                                 |
| 7                           | 18                        | 3.5  | 302        |      | .01                      | 1.0                               |                                    | 106            |                     | 101         | 248                           | 68                                 |
| 8                           | 21                        | 3.5  | 303        |      | .01                      | 1.0                               | 864.922                            | 107            |                     | 101         | 248                           | 68                                 |
| B 1                         | 0                         | 3.0  | 100        |      | .01                      | 1.0                               |                                    | 92             |                     | 91          | 235                           | 68                                 |
| 2                           | 3                         | 3.0  | 185        |      | .01                      | 1.0                               |                                    | 94             |                     | 92          | 245                           | 68                                 |
| 3                           | 6                         | 3.5  | 196        |      | .02                      | 1.5                               |                                    | 94             |                     | 93          | 243                           | 66                                 |
| 4                           | 9                         | 4.0  | 270        |      | .02                      | 1.5                               |                                    | 96             |                     | 93          | 242                           | 68                                 |
| 5                           | 12                        | 4.5  | 286        |      | .02                      | 1.5                               |                                    | 97             |                     | 93          | 245                           | 68                                 |
| 6                           | 15                        | 4.5  | 290        |      | .02                      | 1.5                               |                                    | 99             |                     | 94          | 245                           | 68                                 |
| 7                           | 18                        | 4.0  | 288        |      | .01                      | 1.0                               |                                    | 99             |                     | 94          | 245                           | 68                                 |
| 8                           | 21                        | 4.0  | 288        |      | .01                      | 1.0                               | 877.601                            | 99             |                     | 94          | 245                           | 68                                 |
|                             |                           |  |            |      |                          |                                   | TOTAL 543-25.636                   |                |                     |             |                               |                                    |

(Stack Geometry)

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

OEHL FORM 15  
APR 79 112

(Velocity and Temperature Traverse)

DATE

BOILER NUMBER

Oil-fired Bldg 1206 (one boiler only tested)

INSIDE STACK DIAMETER

13.88元

Inches

STATION PRESSURE

29.840

In Hg

STACK STATIC PRESSURE

- .005

In H<sub>2</sub>O

**SAMPLING TEAM**

| TRAVERSE POINT NUMBER | VELOCITY HEAD, V <sub>p</sub> IN H <sub>2</sub> O | $\sqrt{V_p}$ | STACK TEMPERATURE ( <sup>o</sup> F) |
|-----------------------|---|--------------|-------------------------------------|
| 1                     |   | 0            |                                     |
| 2                     |   | 0            |                                     |
| 3                     |   | 0            |                                     |
| 4                     | .02   | 6            |                                     |
| 5                     | .02   | 1            |                                     |
| 6                     |   | 0            |                                     |
| 7                     |   | 1            |                                     |
| 8                     |   | 0            |                                     |
|                       |   |              |                                     |
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|                       |   |              |                                     |
|                       |   |              |                                     |
|                       |   |              |                                     |
| <b>AVERAGE</b>        |   |              |                                     |

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|   |  |            |
|---|--|------------|
| BASE<br><b>Show AF13, SC</b>                    | DATE<br><b>15 Aug 88</b>                 | RUN NUMBER |
| BUILDING NUMBER<br><b><del>11614</del> 1206</b> | SOURCE NUMBER<br><b>OIL FIRED BOILER</b> |            |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (if needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)                | 253.4                | 200 mL                 | 53.4                 |
| IMPINGER 2 (H2O)                | 205                  | 200 mL                 | 5                    |
| IMPINGER 3 (Dry)                | 1 mL                 | 0                      | 1                    |
| IMPINGER 4 (Silica Gel)         | 206 gras             | 200 gras               | 6                    |
| Total Weight of Water Collected |                      |                        | 65.4 gm              |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$



## **APPENDIX L**

### **Building 1402, Hot Water Boiler Field Data**

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# PARTICULATE SAMPLING DATA SHEET

| SCHEMATIC OF STACK CROSS SECTION            |                     |                            |                 | EQUATIONS         |                    |                           |                           | AMBIENT TEMP           |   |                         |                      |                           |              |                 |    |                       |
|---|---------------------|----------------------------|-----------------|-------------------|--------------------|---------------------------|---------------------------|------------------------|---|-------------------------|----------------------|---------------------------|--------------|-----------------|----|-----------------------|
| RUN NUMBER                                  | DATE                | PLAN                       | BASE            | SAMPLE BOX NUMBER | METER BOX NUMBER   | Qw/Qm                     | Co                        | OR = °F + 460          | H = $\left[ \frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$ | STATION PRESS           | HEATER BOX TEMP      | PROBE HEATER SETTING      | PROBE LENGTH | NOZZLE AREA (A) | Cp | DRY GAS FRACTION (Fd) |
|   |                     |                            |                 |                   |                    |                           |                           |                        |   |                         |                      |                           |              |                 |    |                       |
| TRAVERSE POINT NUMBER                       | SAMPLING TIME (min) | STACK PRESSURE (inches Hg) | STACK TEMP (°F) | STACK TEMP (°F)   | VELOCITY HEAD (Vp) | ORIFICE DIFF. PRESS. (in) | GAS SAMPLE VOLUME (cu ft) | GAS METER TEMP IN (°F) | GAS METER TEMP AVG (Tm) (°F)  | GAS METER TEMP OUT (°F) | SAMPLE BOX TEMP (°F) | IMPINGER OUTLET TEMP (°F) |              |                 |    |                       |
| 1   | 0                   | -2.5                       | 249             | 249               | .01                | 1.4                       | 946.880                   | 80                     |   | 80                      | 246                  | 68                        |              |                 |    |                       |
| 2   | 5                   | -2.5                       | 262             | 262               | .03                | 1.4                       |                           | 84                     |   | 81                      | 243                  | 66                        |              |                 |    |                       |
| 3   | 10                  | -2.5                       | 271             | 271               | .04                | 1.4                       |                           | 87                     |   | 83                      | 241                  | 68                        |              |                 |    |                       |
| 4   | 13                  | -2.5                       | 266             | 266               | .02                | 1.4                       | 958.137                   | 91                     |   | 85                      | 243                  | 68                        |              |                 |    |                       |
| 1   | 0                   | -2.5                       | 217             | 217               | .03                | 1.4                       |                           | 94                     |   | 89                      | 243                  | 68                        |              |                 |    |                       |
| 2   | 5                   | -2.5                       | 231             | 231               | .03                | 1.4                       |                           | 97                     |   | 90                      | 244                  | 68                        |              |                 |    |                       |
| 3   | 10                  | -2.5                       | 267             | 267               | .04                | 1.4                       |                           | 99                     |   | 91                      | 241                  | 68                        |              |                 |    |                       |
| 4   | 13                  | -2.5                       | 278             | 278               | .02                | 1.4                       | 969.184                   | 100                    |   | 92                      | 240                  | 68                        |              |                 |    |                       |
| TOTAL TIME 39 min 30 sec (BOILER SHUT DOWN) |                     |                            |                 |                   |                    |                           |                           | TOTAL STS = 22,304     |   |                         |                      |                           |              |                 |    |                       |

[illegible]

(Velocity and Temperature Traverse)

DATE

17 JUL 88

BLDG 1402

Inches

In Hg

In H<sub>2</sub>O

STACK TEMPERATURE (°F)

12

12

12

12

$$\text{AVG} = 12^\circ$$

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# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|   |                          |            |
|---|--------------------------|------------|
| BASE<br><b>SHAW AFB, SC</b>                               | DATE<br><b>17 Aug 88</b> | RUN NUMBER |
| BUILDING NUMBER<br><b>BLDG 1403</b><br><b>BX NCO Club</b> | SOURCE NUMBER            |            |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (if needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)                | 262.0                | 200.0                  | 62.0                 |
| IMPINGER 2 (H2O)                | 184.0                | 200.0                  | - 16.0               |
| IMPINGER 3 (Dry)                | Ø                    | Ø                      | Ø                    |
| IMPINGER 4 (Silica Gel)         | 205.6                | 200.0                  | 5.6                  |
| Total Weight of Water Collected |                      |                        | 51.6 gm              |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

## **APPENDIX M**

### **Building 1422, Hot Water Boiler Field Data**

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|  |  |
|--|--|
| BASE<br>Shaw   | PLANT<br>BX BLDG 1422                                      |
| DATE<br>17 Aug 88  | SAMPLING TEAM  |
| SOURCE TYPE AND MAKE<br>oil-fired <del>Power Flame Div Inc, Parsons, KS</del> Spencer Bolt 90HSD |  |
| SOURCE NUMBER  | INSIDE STACK DIAMETER<br>17.5<br>30 PSI max pres<br>Inches |
| RELATED CAPACITY   | TYPE FUEL<br>oil 17-30 gal per hr                          |
| DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER<br>20.5 in (3 in)                             | Inches   |
| NUMBER OF TRAVERSES<br>2   | NUMBER OF POINTS/TRAVERSE<br>8                             |

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APR 78

(Velocity and Temperature Traverse)

**BASE**

STRAW

DATE \_\_\_\_\_

17 AUG 8 P

BOILER NUMBER

BX BLDG 1422

INSIDE STACK DIAMETER

17.5

Inches

STATION PRESSURE

29.850

In Hg

STACK STATIC PRESSURE

-01

In H2O

**SAMPLING TEAM**

| TRAVERSE POINT NUMBER | VELOCITY HEAD, V <sub>p</sub> IN H <sub>2</sub> O | $\alpha$        | STACK TEMPERATURE (°F) |
|-----------------------|---|-----------------|------------------------|
| 1                     |   | CLYCLONIC<br>10 |                        |
| 2                     |   | 10              |                        |
| 3                     |   | 10              |                        |
| 4                     |   | 5               |                        |
| 5                     |   | 5               |                        |
| 6                     |   | 10              |                        |
| 7                     |   | 10              |                        |
| 8                     |   | 12              |                        |
|                       |   | Avg = 9°        |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
|                       |   |                 |                        |
| <b>AVERAGE</b>        |   |                 |                        |

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|  |  |               |
|--|--|---------------|
| BASE<br><div style="font-size: 1.2em; font-family: cursive;">Sitaw AF-B</div>              | DATE<br><div style="font-size: 1.2em; font-family: cursive;">17 AUG 88</div> | RUN NUMBER    |
| BUILDING NUMBER<br><div style="font-size: 1.2em; font-family: cursive;">BX BLDG 1422</div> |  | SOURCE NUMBER |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (If needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)                | 276.0                | 200.0                  | 76.0                 |
| IMPINGER 2 (H2O)                | 184.0                | 200.0                  | -16.0                |
| IMPINGER 3 (Dry)                | ∅                    | ∅                      | ∅                    |
| IMPINGER 4 (Silica Gel)         | 206.8                | 200.0                  | 6.8                  |
| Total Weight of Water Collected |                      |                        | 66.8 gm              |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

**APPENDIX N**  
**Steam Boiler Field Data**

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## PARTICULATE SAMPLING DATA SHEET

| Schematic of Stack Cross Section  |                          |                          |                 | EQUATIONS   |                    |                           |                           | AMBIENT TEMP   |                      |                           |  |  |
|---|--------------------------|--------------------------|-----------------|---|--------------------|---------------------------|---------------------------|--|----------------------|---------------------------|--|--|
| Run Number  | Oil-fired - water boiler | DATE                     | 16 Aug 88       | PLANT   | Bldg 1604          | BASE                      | Shaw AF B                 | SAMPLE BOX NUMBER  |                      |                           |  |  |
| METER BOX NUMBER  |                          |                          |                 |   |                    |                           |                           |  |                      |                           |  |  |
| Qw/Qm   |                          |                          |                 |   |                    |                           |                           |  |                      |                           |  |  |
| Co  |                          |                          |                 |   |                    |                           |                           |  |                      |                           |  |  |
| <p>VELOCITY AP'S TAKEN WITH A DETERMINED P.T. FOR ASSEMBLY DUE TO SMALL INSIDE STACK DIAMETER (7.5") SAMPLE WAS TAKEN AT CENTROID OF STACK AND PARAMETERS MONITORED AT 5 MIN INTERVALS. AP'S NOTED ON DATA SHEET NO. 2.</p> |                          |                          |                 | <p>Pre leak check good at 15 in Hg<br/>Post Good at 8 in Hg<br/>Ts = 151.8<br/>Tm = 104.5<br/>ΔH = 1.4<br/>PSB = 8.84/6</p> |                    |                           |                           | <p>OF<br/>STATION PRESS<br/>29.806<br/>HEATER BOX TEMP<br/>PROBE HEATER SETTING<br/>PROBE LENGTH<br/>72<br/>NOZZLE AREA<br/>1.51<br/>Cp<br/>84<br/>DRY GAS FRACTION (Fd)</p> |                      |                           |  |  |
| TRAVERSE POINT NUMBER   | SAMPLING TIME (min)      | STATIC PRESSURE (in H2O) | STACK TEMP (°F) | STACK TEMP (°F)   | VELOCITY HEAD (Vp) | ORIFICE DIFF. PRESS. (in) | GAS SAMPLE VOLUME (cu ft) | GAS METER TEMP (°F)  | SAMPLE BOX TEMP (°F) | IMPINGER OUTLET TEMP (°F) |  |  |
| A 1   | 0                        | -2.5                     | 151             |   |                    | 1.4                       | 924.000                   | 102  | 250                  | 68                        |  |  |
| A 2   | 2.5                      | -2.5                     | 153             |   |                    | 1.4                       |                           | 102  | 250                  | 67                        |  |  |
| A 3   | 5.0                      | -2.5                     | 155             |   |                    | 1.4                       |                           | 103  | 250                  | 66                        |  |  |
| A 4   | 7.5                      | -2.5                     | 155             |   |                    | 1.4                       |                           | 104  | 249                  | 65                        |  |  |
| A 5   | 10.0                     | -2.5                     | 158             | .15   |                    | 1.4                       |                           | 104  | 250                  | 65                        |  |  |
| A 6   | 12.5                     | -2.5                     | 160             | .15   |                    | 1.4                       |                           | 105  | 251                  | 65                        |  |  |
| A 7   | 15.0                     | -2.5                     | 164             |   |                    | 1.4                       |                           | 106  | 250                  | 65                        |  |  |
| A 8   | 17.5                     | -2.5                     | 166             |   |                    | 1.4                       | 935.425                   | 107  | 250                  | 66                        |  |  |
| B 1   | 0                        | -2.5                     | 146             |   |                    | 1.4                       |                           | 108  | 243                  | 68                        |  |  |
| B 2   | 2.5                      | -2.5                     | 140             |   |                    | 1.4                       |                           | 108  | 241                  | 67                        |  |  |
| B 3   | 5.0                      | -2.5                     | 136             |   |                    | 1.4                       |                           | 108  | 241                  | 66                        |  |  |
| B 4   | 7.5                      | -2.5                     | 152             |   |                    | 1.4                       |                           | 108  | 244                  | 66                        |  |  |
| B 5   | 10.0                     | -2.5                     | 154             |   |                    | 1.4                       |                           | 107  | 249                  | 66                        |  |  |
| B 6   | 12.5                     | -2.5                     | 147             |   |                    | 1.4                       |                           | 107  | 250                  | 67                        |  |  |
| B 7   | 15.0                     | -2.5                     | 145             |   |                    | 1.4                       |                           | 107  | 249                  | 67                        |  |  |
| B 8   | 17.5                     | -2.5                     | 146             |   |                    | 1.4                       | 946.645                   | 107  | 258                  | 68                        |  |  |
|   |                          |                          |                 | TOTAL ST3 = 22.645  |                    |                           |                           |  |                      |                           |  |  |

(Stack Geometry)

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

OEHL FORM 15  
APR 78 130



(Velocity and Temperature Traverse)

**BASE**

DATE \_\_\_\_\_

BOILER NUMBER

INSIDE STACK DIAMETER

STATION PRESSURE

STACK STATIC PRESSURE

**SAMPLING TEAM**

[illegible]

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|                         |                          |                         |
|-------------------------|--------------------------|-------------------------|
| <b>BASE</b><br>SHAW AFB | <b>DATE</b><br>16 Aug 84 | <b>RUN NUMBER</b><br>PP |
|-------------------------|--------------------------|-------------------------|

|                                |                                   |
|--------------------------------|-----------------------------------|
| <b>BUILDING NUMBER</b><br>1604 | <b>SOURCE NUMBER</b><br>OIL FIRED |
|--------------------------------|-----------------------------------|

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (If needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)                | 244                  | 200                    | 44                   |
| IMPINGER 2 (H2O)                | 206                  | 200                    | 6                    |
| IMPINGER 3 (Dry)                | 1                    | 0                      | 1                    |
| IMPINGER 4 (Silica Gel)         | 206.2                | 200                    | 6.2                  |
| Total Weight of Water Collected |                      |                        | 57.2 gm              |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

## **APPENDIX O**

### **Building 1614, Steam Boiler Field Data**

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(Stack Geometry)

OEHL FORM 15  
APR 78



# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|                                |  |                          |                                   |            |  |
|--------------------------------|--|--------------------------|-----------------------------------|------------|--|
| BASE<br><b>SHAW AFB</b>        |  | DATE<br><b>16 Aug 88</b> |                                   | RUN NUMBER |  |
| BUILDING NUMBER<br><b>1614</b> |  |                          | SOURCE NUMBER<br><b>Boiler #1</b> |            |  |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (If needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                        |                        |                      |
|---------------------------------|------------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm)   | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H <sub>2</sub> O)   | <del>200.0</del> 244.0 | 200.0                  | 44.0                 |
| IMPINGER 2 (H <sub>2</sub> O)   | 207.0                  | 200.0                  | 7.0                  |
| IMPINGER 3 (Dry)                | Ø                      | Ø                      | Ø                    |
| IMPINGER 4 (Silica Gel)         | 206.7                  | 200.0                  | 6.7                  |
| Total Weight of Water Collected |                        |                        | 57.7 gm              |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$



# PARTICULATE SAMPLING DATA SHEET

| SCHEMATIC OF STACK CROSS SECTION  |                     |                          |                 | EQUATIONS   |                    |                               |                           | AMBIENT TEM  |                      |                           |  |
|---|---------------------|--------------------------|-----------------|---|--------------------|-------------------------------|---------------------------|--|----------------------|---------------------------|--|
| TRaverse POINT NUMBER   | SAMPLING TIME (min) | STATIC PRESSURE (in. Hg) | STACK TEMP (°F) | STACK TEMP (°F)   | VELOCITY HEAD (Vp) | ORIFICE DIFF. PRESS. (in. Hg) | GAS SAMPLE VOLUME (cu ft) | GAS METER TEMP (°F)  | SAMPLE BOX TEMP (°F) | IMPINGER OUTLET TEMP (°F) |  |
| <p>DATE: 16 AUG 58</p> <p>PLANT: BLDG-1614, BOILER #2</p> <p>BASE: SHAW AFB</p> <p>SAMPLE BOX NUMBER: RAC</p> <p>METER BOX NUMBER: NUTEC</p> <p>Qw/Qm</p> <p>Co</p> |                     |                          |                 | <p>°R = °F + 460</p> <p><math>H = \left[ \frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p</math></p> <p>Pre checked at 1614 Hg</p> <p><math>\bar{B} = 260.3</math></p> <p><math>\bar{T}_m = 88.6</math></p> <p><math>\Delta H = 1.4</math></p> <p>PSTS = 4.8660</p> |                    |                               |                           | <p>AMBIENT TEM: 81</p> <p>STATION PRESS: 29.866</p> <p>HEATER BOX TEMP</p> <p>PROBE HEATER SETTING</p> <p>PROBE LENGTH: 72</p> <p>NOZZLE AREA: .51</p> <p>Cp: .84</p> <p>DRY GAS FRACTION (Fd)</p> |                      |                           |  |
| A 1   | 0                   | -2.5                     | 129             | 0.25  | 1.4                | 877.846                       | 81                        | 79   | 231                  | 63                        |  |
| A 2   | 5                   | -2.5                     | 294             | 0.40  | 1.4                |                               | 85                        | 81   | 235                  | 64                        |  |
| A 3   | 10                  | -2.5                     | 310             | 0.40  | 1.4                | 889.335                       | 85                        | 83   | 239                  | 66                        |  |
| A 4   | 15                  | -2.5                     | 317             | 0.25  | 1.4                |                               | 43                        | 85   | 241                  | 68                        |  |
| B 1   | 0                   | -2.5                     | 136             | 0.25  | 1.4                |                               | 93                        | 85   | 240                  | 68                        |  |
| B 2   | 5                   | -2.5                     | 278             | 0.40  | 1.4                |                               | 95                        | 88   | 243                  | 65                        |  |
| B 3   | 10                  | -2.5                     | 308             | 0.40  | 1.4                | 900.760                       | 97                        | 91   | 243                  | 68                        |  |
| B 4   | 15                  | -2.5                     | 317             | 0.30  | 1.4                |                               | 100                       | 92   | 244                  | 67                        |  |
|   |                     |                          |                 | TOTAL STS = 22.87   |                    |                               |                           |  |                      |                           |  |

(Stack Geometry)

OEHL FORM 15  
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**PRELIMINARY SURVEY DATA SHEET NO. 2**  
(Velocity and Temperature Traverse)

|   |                           |
|---|---------------------------|
| BASE<br><b>SITAW AFB</b>                      | DATE<br><b>16 DATE 88</b> |
| BOILER NUMBER<br><b>BLDG 1614, BOILER # 2</b> |                           |
| INSIDE STACK DIAMETER<br><b>16</b> Inches     |                           |
| STATION PRESSURE<br><b>29.806</b> In Hg       |                           |
| STACK STATIC PRESSURE<br><b>-0.01</b> In H2O  |                           |
| SAMPLING TEAM                                 |                           |

| TRAVERSE POINT NUMBER | VELOCITY HEAD, $V_p$ IN H2O | $\alpha$ <del><math>\sqrt{V_p}</math></del> <b>cyclonic</b> | STACK TEMPERATURE (°F) |
|-----------------------|-----------------------------|---|------------------------|
| 1                     |                             | 10  |                        |
| 2                     |                             | 10  |                        |
| 3                     |                             | 10  |                        |
| 4                     |                             | 10  |                        |
|                       |                             | <b>AVG = 10°</b>  |                        |
|                       |                             |   |                        |
|                       |                             |   |                        |
|                       |                             |   |                        |
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|                       |                             |   |                        |
|                       |                             |   |                        |
|                       |                             |   |                        |
| AVERAGE               |                             |   |                        |

# AIR POLLUTION PARTICULATE ANALYTICAL DATA

|                                |                                    |            |
|--------------------------------|------------------------------------|------------|
| BASE<br><i>SITAW AF 3</i>      | DATE<br><i>16 AUG 88</i>           | RUN NUMBER |
| BUILDING NUMBER<br><i>1614</i> | SOURCE NUMBER<br><i>BOILER # 2</i> |            |

| I. PARTICULATES                             |                      |                        |                          |
|---|----------------------|------------------------|--------------------------|
| ITEM  | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT PARTICLES<br>(gm) |
| FILTER NUMBER                               |                      |                        |                          |
| ACETONE WASHINGS (Probe, Front Half Filter) |                      |                        |                          |
| BACK HALF (if needed)                       |                      |                        |                          |
| Total Weight of Particulates Collected      |                      |                        | gm                       |

| II. WATER                       |                      |                        |                      |
|---------------------------------|----------------------|------------------------|----------------------|
| ITEM                            | FINAL WEIGHT<br>(gm) | INITIAL WEIGHT<br>(gm) | WEIGHT WATER<br>(gm) |
| IMPINGER 1 (H2O)                | <i>238.0</i>         | <i>200.0</i>           | <i>38.0</i>          |
| IMPINGER 2 (H2O)                | <i>209.0</i>         | <i>200.0</i>           | <i>9.0</i>           |
| IMPINGER 3 (Dry)                | <i>Ø</i>             | <i>Ø</i>               | <i>Ø</i>             |
| IMPINGER 4 (Silica Gel)         | <i>205.3</i>         | <i>200.0</i>           | <i>5.3</i>           |
| Total Weight of Water Collected |                      |                        | <i>52.3</i> gm       |

| III. GASES (Dry)      |               |               |               |               |         |
|-----------------------|---------------|---------------|---------------|---------------|---------|
| ITEM                  | ANALYSIS<br>1 | ANALYSIS<br>2 | ANALYSIS<br>3 | ANALYSIS<br>4 | AVERAGE |
| VOL % CO <sub>2</sub> |               |               |               |               |         |
| VOL % O <sub>2</sub>  |               |               |               |               |         |
| VOL % CO              |               |               |               |               |         |
| VOL % N <sub>2</sub>  |               |               |               |               |         |

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

**APPENDIX P**  
**Calibration Data**

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# METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 12 Jul 88

Meter box number 2010 NUTECH

Barometric pressure,  $P_b =$  29.119 in. Hg Calibrated by Fagin & Scott

| Val<br>in. H <sub>2</sub> O | Orifice<br>manometer<br>setting<br>( $\Delta H$ ),<br>in. H <sub>2</sub> O | Gas volume   |   | Temperature                             |                                 |                                  | Time<br>( $\theta$ ),<br>min           | $Y_i$ | $\Delta H@_i$<br>in. H <sub>2</sub> O |       |
|-----------------------------|--|--|---|---|---------------------------------|----------------------------------|--|-------|---------------------------------------|-------|
|                             |  | Wet test<br>meter<br>( $V_w$ ),<br>ft <sup>3</sup> | Dry gas<br>meter<br>( $V_d$ ),<br>ft <sup>3</sup> | Wet test<br>meter<br>( $t_w$ ),<br>°F/R | Dry gas meter                   |                                  |  |       |                                       |       |
|                             |  |  |   |   | Inlet<br>( $t_{d_i}$ ),<br>°F/R | Outlet<br>( $t_{d_o}$ ),<br>°F/R | Avg <sup>a</sup><br>( $t_d$ ),<br>°F/R |       |                                       |       |
| 4                           | 0.5  | 5  | 4.668   | 78<br>79 538                            | 76<br>83 539.5                  | 75<br>78 536.5                   | 538                                    | 13.1  | 1.070                                 | 2.010 |
| 4                           | 1.0  | 5  | 4.670   | 78<br>78 538                            | 89<br>81 546.5                  | 78<br>81 539.5                   | 543                                    | 9.3   | 1.078                                 | 2.008 |
| 4                           | 1.5  | 10   | 9.390   | 78<br>78 538                            | 90<br>96 553                    | 82<br>86 544                     | 548.5                                  | 15.5  | 1.082                                 | 2.070 |
| 4                           | 2.0  | 10   | 9.455   | 79<br>80 539.5                          | 96<br>101 558.5                 | 87<br>90 548.5                   | 553.5                                  | 13.5  | 1.070                                 | 2.087 |
| 4                           | 3.0  | 10   | 9.470   | 80<br>81 540.5                          | 101<br>106 563.5                | 90<br>93 551.5                   | 557.5                                  | 11.1  | 1.081                                 | 2.109 |
| 4                           | 4.0  | 10.1   | 9.590   | 81<br>81 541                            | 106<br>109 567.5                | 94<br>96 555                     | 561.3                                  | 9.8   | 1.082                                 | 2.138 |
|                             |  |  |   |   |                                 |                                  |  | Avg   | 1.077                                 | 2.070 |

| $\Delta H$ ,<br>in.<br>H <sub>2</sub> O | $\frac{\Delta H}{13.6}$ | $Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$ | $\Delta H@_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[ \frac{(t_w + 460) \theta}{V_w} \right]^2$ |
|---|-------------------------|---|---|
| 0.5                                     | 0.0368                  | $y_1 = \frac{(5)(29.119)(538)}{(4.668)(29.119 + \frac{0.5}{13.6})(538)}$          | $H@_1 = \frac{(0.0317)(0.5)}{(29.119)(538)} \left[ \frac{(538)(13.1)}{5} \right]^2$                     |
| 1.0                                     | 0.0737                  | $y_2 = \frac{(5)(29.119)(543)}{(4.67)(29.119 + \frac{1.0}{13.6})(538)}$           | $H@_2 = \frac{(0.0317)(1)}{(29.119)(543)} \left[ \frac{(538)(9.3)}{5} \right]^2$                        |
| 1.5                                     | 0.110                   | $y_3 = \frac{(10)(29.119)(548.5)}{(9.39)(29.119 + \frac{1.5}{13.6})(538)}$        | $H@_3 = \frac{(0.0317)(1.5)}{(29.119)(548.5)} \left[ \frac{(538)(15.5)}{10} \right]^2$                  |
| 2.0                                     | 0.147                   | $y_4 = \frac{(10)(29.119)(553.5)}{(9.455)(29.119 + \frac{2.0}{13.6})(539.5)}$     | $H@_4 = \frac{(0.0317)(2.0)}{(29.119)(553.5)} \left[ \frac{(539.5)(13.5)}{10} \right]^2$                |
| 3.0                                     | 0.221                   | $y_5 = \frac{(10)(29.119)(557.5)}{(9.47)(29.119 + \frac{3.0}{13.6})(540.5)}$      | $H@_5 = \frac{(0.0317)(3)}{(29.119)(557.5)} \left[ \frac{(540.5)(11.1)}{10} \right]^2$                  |
| 4.0                                     | 0.294                   | $y_6 = \frac{(10.1)(29.119)(561.3)}{(9.59)(29.119 + \frac{4.0}{13.6})(541)}$      | $H@_6 = \frac{(0.0317)(4)}{(29.119)(561.3)} \left[ \frac{(541)(9.8)}{10.1} \right]^2$                   |

<sup>a</sup> If there is only one thermometer on the dry gas meter, record the temperature under  $t_d$ .

# METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 13 Jul 88

Meter box number RAC

Barometric pressure,  $P_b = 29.131$  in. Hg Calibrated by PAUL E SCOTT  $R = (4.23)$

| Orifice<br>manometer<br>setting<br>( $\Delta H$ ),<br>in. H <sub>2</sub> O | Gas volume   |   | Temperature                           |                               |                                |                                      | Time<br>( $\theta$ ),<br>min | $Y_i$ | $\Delta H \theta_i$<br>in. H <sub>2</sub> O |
|--|--|---|---------------------------------------|-------------------------------|--------------------------------|--------------------------------------|------------------------------|-------|---|
|  | Wet test<br>meter<br>( $V_w$ ),<br>ft <sup>3</sup> | Dry gas<br>meter<br>( $V_d$ ),<br>ft <sup>3</sup> | Wet test<br>meter<br>( $t_w$ ),<br>°R | Dry gas meter                 |                                |                                      |                              |       |   |
|  |  |   |                                       | Inlet<br>( $t_{d_i}$ ),<br>°R | Outlet<br>( $t_{d_o}$ ),<br>°R | Avg <sup>a</sup><br>( $t_d$ ),<br>°R |                              |       |   |
| 0.5  | 5  | 4.712   | <del>78</del><br>77 537.5             | <del>94</del><br>101 557.5    | <del>76</del><br>78 537        | 548.25                               | 12.0                         | 1.081 | 1.652                                       |
| 1.0  | 5.2  | 4.940   | <del>77</del><br>78 537.5             | <del>104</del><br>109 560.5   | <del>78</del><br>80 539        | 552.75                               | 8.9                          | 1.080 | 1.666                                       |
| 1.5  | 10   | 9.600   | <del>78</del><br>78 538               | <del>111</del><br>113 572     | <del>81</del><br>84 542.5      | 557.25                               | 15.0                         | 1.075 | 1.908                                       |
| 2.0  | 10   | 9.529   | <del>78</del><br>79 538.5             | <del>115</del><br>116 575.5   | <del>85</del><br>86 545.5      | 560.5                                | 13.0                         | 1.087 | 1.903                                       |
| 3.0  | 10   | 9.636   | <del>79</del><br>79 539               | <del>117</del><br>120 578.5   | <del>87</del><br>88 547.5      | 563.0                                | 14.6                         | 1.076 | 1.893                                       |
| 4.0  | 10   | 9.605   | <del>79</del><br>79 539               | <del>120</del><br>122 581     | <del>88</del><br>89 548.5      | 564.75                               | 9.1                          | 1.080 | 1.391                                       |
|  |  |   |                                       |                               |                                |                                      | Avg                          | 1.080 | 1.736                                       |

| $\Delta H$ ,<br>in.<br>H <sub>2</sub> O | $\frac{\Delta H}{13.6}$ | $Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$                         | $\Delta H \theta_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[ \frac{(t_w + 460) \theta}{V_w} \right]^2$       |
|---|-------------------------|---|---|
| 0.5                                     | 0.0368                  | $Y_1 = \frac{(5 \times 29.131 \times 548.25)}{(4.712 \times 29.131 + 5/13.6 \times 537.5) (77 + 460)}$    | $H_{\theta 1} = \frac{(0.0317 \times 0.5)}{29.131 (548.25)} \left[ \frac{(537.5) (12.0)}{5} \right]^2$              |
| 1.0                                     | 0.0737                  | $Y_2 = \frac{(5.2 \times 29.131 \times 552.75)}{(4.94 \times 29.131 + 1.0/13.6 \times 537.5) (77 + 460)}$ | $H_{\theta 2} = \frac{(0.0317 \times 1.0)}{(29.131 \times 552.75)} \left[ \frac{(537.5 \times 8.9)}{5.2} \right]^2$ |
| 1.5                                     | 0.110                   | $Y_3 = \frac{(10 \times 29.131 \times 557.25)}{(9.6 \times 29.131 + 1.5/13.6 \times 538) (78 + 460)}$     | $H_{\theta 3} = \frac{(0.0317 \times 1.5)}{(29.131 \times 557.25)} \left[ \frac{(538 \times 15)}{10} \right]^2$     |
| 2.0                                     | 0.147                   | $Y_4 = \frac{(10 \times 29.131 \times 560.5)}{(9.529 \times 29.131 + 2/13.6 \times 538.5) (78 + 460)}$    | $H_{\theta 4} = \frac{(0.0317 \times 2.0)}{(29.131 \times 560.5)} \left[ \frac{(538.5 \times 13)}{10} \right]^2$    |
| 3.0                                     | 0.221                   | $Y_5 = \frac{(10 \times 29.131 \times 563)}{(9.636 \times 29.131 + 3/13.6 \times 539) (79 + 460)}$        | $H_{\theta 5} = \frac{(0.0317 \times 3.0)}{(29.131 \times 563.0)} \left[ \frac{(539 \times 14.6)}{10} \right]^2$    |
| 4.0                                     | 0.294                   | $Y_6 = \frac{(10 \times 29.131 \times 564.75)}{(9.605 \times 29.131 + 4/13.6 \times 539) (79 + 460)}$     | $H_{\theta 6} = \frac{(0.0317 \times 3.0)}{(29.131 \times 564.75)} \left[ \frac{(539 \times 9.1)}{10} \right]^2$    |

<sup>a</sup> If there is only one thermometer on the dry gas meter, record the temperature under  $t_d$ .



# POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number Post-078 Date 9 Aug 88 Meter box number \_\_\_\_\_ Plant Skidway AFB <sup>Post</sup> RE SHAW  
 Barometric pressure,  $P_b = 29.76$  in. Hg Dry gas meter number NOTECH Pretest Y 1.077

| Orifice<br>manometer<br>setting,<br>( $\Delta H$ ),<br>in. $H_2O$ | Gas volume                                |  | Temperature                                    |  |   | Time<br>( $\theta$ ),<br>min | Vacuum<br>setting,<br>in. Hg | $Y_i$ | $Y_i$<br>$\frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$ |
|---|---|--|--|--|---|------------------------------|------------------------------|-------|--|
|   | Wet test<br>meter<br>( $V_w$ ),<br>$ft^3$ | Dry gas<br>meter<br>( $V_d$ ),<br>$ft^3$ | Wet test<br>meter<br>( $t_w$ ),<br>$^{\circ}F$ | Inlet<br>( $t_{d_i}$ ),<br>$^{\circ}F$ | Outlet<br>( $t_{d_o}$ ),<br>$^{\circ}F$ |                              |                              |       |  |
| 2.5   | 10  | 9.327                                    | 79 53.9  | 84 54.5                                | 79 53.5                                 | 12.2                         | -20.0                        | 1.072 | $\frac{10 \times 29.76 \times 542.25}{19.327 \times 29.76 + 2.5/13.6 \times 539}$    |
| 2.5   | 10  | 9.336                                    | 79 53.9  | 84 54.5                                | 80 54.1                                 | 12.2                         | -20.0                        | 1.074 | $\frac{10 \times 29.76 \times 544.0}{19.336 \times 29.76 + 2.5/13.6 \times 539}$     |
| 2.5   | 10  | 9.368                                    | 79 53.5  | 84 54.5                                | 82 54.3                                 | 12.2                         | -20.0                        | 1.074 | $\frac{10 \times 29.76 \times 546.25}{19.368 \times 29.76 + 2.5/13.6 \times 539.5}$  |
| $Y = 1.073$   |   |  |  |  |   |                              |                              |       |  |

<sup>a</sup> If there is only one thermometer on the dry gas meter, record the temperature under  $t_d$  where

$V_w$  = Gas volume passing through the wet test meter,  $ft^3$ .  
 $V_d$  = Gas volume passing through the dry gas meter,  $ft^3$ .  
 $t_w$  = Temperature of the gas in the wet test meter,  $^{\circ}F$ .  
 $t_{d_i}$  = Temperature of the inlet gas of the dry gas meter,  $^{\circ}F$ .  
 $t_{d_o}$  = Temperature of the outlet gas of the dry gas meter,  $^{\circ}F$ .  
 $t_d$  = Average temperature of the gas in the dry gas meter, obtained by the average of  $t_{d_i}$  and  $t_{d_o}$ ,  $^{\circ}F$ .  
 $\Delta H$  = Pressure differential across orifice, in.  $H_2O$ .  
 $Y_i$  = Ratio of accuracy of wet test meter to dry gas meter for each run.  
 $Y$  = Average ratio of accuracy of wet test meter to dry gas meter for all three runs;  
 tolerance = pretest  $Y \pm 0.05Y$ .  
 $P_b$  = Barometric pressure, in. Hg.  
 $\theta$  = Time of calibration run, min.

POST Y RANGE: PRETEST  $Y \pm 0.05Y$   
 $= 1.0232 \rightarrow 1.1309$

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units) Eielson (Post)  
SHAW (Pre)

Test number #1 Date 9 Aug 88 Meter box number Plant

Barometric pressure,  $P_b = 29.760$  in. Hg Dry gas meter number **RAC** Pretest Y **1.080**

| Orifice<br>manometer<br>setting,<br>( $\Delta H$ ),<br>in. $H_2O$ | Gas volume                                |  | Temperature                                    |  |   |                              | Vacuum<br>setting,<br>in. Hg | $Y_i$ | $Y_i$                 | $V_w P_b (t_d + 460)$<br><br>$V_d \left( P_b + \frac{\Delta H}{13.6} \right) (t_w + 460)$ |
|---|---|--|--|--|---|------------------------------|------------------------------|-------|-----------------------|---|
|   | Wet test<br>meter<br>( $V_w$ ),<br>$ft^3$ | Dry gas<br>meter<br>( $V_d$ ),<br>$ft^3$ | Wet test<br>meter<br>( $t_w$ ),<br>$^{\circ}F$ | Dry gas meter                          |   | Time<br>( $\theta$ ),<br>min |                              |       |                       |   |
|   |   |  |  | Inlet<br>( $t_{d_i}$ ),<br>$^{\circ}F$ | Outlet<br>( $t_{d_o}$ ),<br>$^{\circ}F$ |                              |                              |       |                       |   |
| 2.5   | 10  | 9.401                                    | 81   | 111                                    | 76                                      | 11.44                        | 20.0                         | 1.097 | (9.401)(29.76)(540.5) | (10)(29.76)(540.5)  |
| 2.5   | 10  | 9.516                                    | 80   | 134                                    | 83                                      | 11.47                        | 20.0                         | 1.104 | (9.516)(29.76)(540.5) | (10)(29.76)(540.5)  |
| 2.5   | 10  | 9.646                                    | 81   | 141                                    | 80                                      | 11.50                        | 20.0                         | 1.101 | (9.646)(29.76)(540.5) | (10)(29.76)(540.5)  |
| $Y = 1.101$   |   |  |  |  |   |                              |                              |       |                       |   |

<sup>a</sup> If there is only one thermometer on the dry gas meter, record the temperature under  $t_d$  where

$V_w$  = Gas volume passing through the wet test meter,  $ft^3$ .

$V_d$  = Gas volume passing through the dry gas meter,  $ft^3$ .

$t_w$  = Temperature of the gas in the wet test meter,  $^{\circ}F$ .

$t_{d_i}$  = Temperature of the inlet gas of the dry gas meter,  $^{\circ}F$ .

$t_{d_o}$  = Temperature of the outlet gas of the dry gas meter,  $^{\circ}F$ .

$t_d$  = Average temperature of the gas in the dry gas meter, obtained by the average of  $t_{d_i}$  and  $t_{d_o}$ ,  $^{\circ}F$ .

$\Delta H$  = Pressure differential across orifice, in.  $H_2O$ .

$Y_i$  = Ratio of accuracy of wet test meter to dry gas meter for each run.

$Y$  = Average ratio of accuracy of wet test meter to dry gas meter for all three runs;  
tolerance = pretest  $Y \pm 0.05Y$ .

$P_b$  = Barometric pressure, in. Hg.

$\theta$  = Time of calibration run, min.

POST Y RANGE = PRETEST  $Y \pm Y$   
 $= 1.026 \rightarrow 1.134$

# POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number 042 Date 6 Sept 88 Meter box number Nitech Plant Post Shaw Pre Griffs  
 Barometric pressure,  $P_b = 29.176$  in. Hg Dry gas meter number 1.077 Pretest Y 1.077

| Orifice<br>manometer<br>setting,<br>( $\Delta H$ ),<br>in. $H_2O$ | Gas volume                                |  | Temperature                                    |  |   | Time<br>( $\Theta$ ),<br>min | Vacuum<br>setting,<br>in. Hg | $Y_i$       | $Y_i$<br>$V_w P_b (t_d + 460)$<br>$V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)$ |
|---|---|--|--|--|---|------------------------------|------------------------------|-------------|---|
|   | Wet test<br>meter<br>( $V_w$ ),<br>$ft^3$ | Dry gas<br>meter<br>( $V_d$ ),<br>$ft^3$ | Wet test<br>meter<br>( $t_w$ ),<br>$^{\circ}F$ | Inlet<br>( $t_{d_i}$ ),<br>$^{\circ}F$ | Outlet<br>( $t_{d_o}$ ),<br>$^{\circ}F$ |                              |                              |             |   |
| 2.5   | 10  | 9.202                                    | 77.537   | 83.78                                  | 80.5                                    | 12.55                        | 20.0                         | 1.088       | $\frac{10 \times 29.176 \times 540}{9.202 \times 29.176 \times 537} Y$            |
| 2.5   | 10  | 9.308                                    | 77.537   | 84.77                                  | 81.5                                    | 12.24                        | 20.0                         | 1.079       | $\frac{10 \times 29.176 \times 540}{9.308 \times 29.176 \times 537} Y$            |
| 2.5   | 10  | 9.500                                    | 77.537   | 86.82                                  | 83.0                                    | 12.20                        | 20.0                         | 1.059       | $\frac{10 \times 29.176 \times 540}{9.500 \times 29.176 \times 537} Y$            |
|   |   |  |  |  |   |                              |                              | $Y = 1.075$ |   |

<sup>a</sup> If there is only one thermometer on the dry gas meter, record the temperature under  $t_d$  where

$V_w$  = Gas volume passing through the wet test meter,  $ft^3$ .

$V_d$  = Gas volume passing through the dry gas meter,  $ft^3$ .

$t_w$  = Temperature of the gas in the wet test meter,  $^{\circ}F$ .

$t_{d_i}$  = Temperature of the inlet gas of the dry gas meter,  $^{\circ}F$ .

$t_{d_o}$  = Temperature of the outlet gas of the dry gas meter,  $^{\circ}F$ .

$t_d$  = Average temperature of the gas in the dry gas meter, obtained by the average of  $t_{d_i}$  and  $t_{d_o}$ ,  $^{\circ}F$ .

$\Delta H$  = Pressure differential across orifice, in.  $H_2O$ .

$Y_i$  = Ratio of accuracy of wet test meter to dry gas meter for each run.

$Y$  = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest  $Y \pm 0.05Y$ .

$P_b$  = Barometric pressure, in. Hg.

$\Theta$  = Time of calibration run, min.

Post Y RANGE = PRETEST  $Y \pm 0.05 Y$   
 $= 1.0232 \rightarrow 1.1309$

# POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number One Date 6 Sept 88 Meter box number Nutech Plant Post Shaw / Pre Gr. 33  
 Barometric pressure,  $P_b = 29.17$  in. Hg Dry gas meter number Pretest Y 1.077

| Orifice<br>manometer<br>setting,<br>( $\Delta H$ ),<br>in. $H_2O$ | Gas volume                                |  | Temperature                                    |  |   |                                      | Vacuum<br>setting,<br>in. Hg | $Y_i$       | $Y_i$<br>$V_w P_b (t_d + 460)$<br>$V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)$ |
|---|---|--|--|--|---|--------------------------------------|------------------------------|-------------|---|
|   | Wet test<br>meter<br>( $V_w$ ),<br>$ft^3$ | Dry gas<br>meter<br>( $V_d$ ),<br>$ft^3$ | Wet test<br>meter<br>( $t_w$ ),<br>$^{\circ}F$ | Dry gas meter                          |   |                                      |                              |             |   |
|   |   |  |  | Inlet<br>( $t_{d_i}$ ),<br>$^{\circ}F$ | Outlet<br>( $t_{d_o}$ ),<br>$^{\circ}F$ | Average<br>( $t_d$ ),<br>$^{\circ}F$ |                              |             |   |
| 2.5   | 10  | 9.202                                    | 77   | 83                                     | 78                                      | 80.5                                 | 20.0                         | 1.088       | $(9.202)(29.17)(537)$   |
| 2.5   | 10  | 9.308                                    | 77   | 84                                     | 77                                      | 81.5                                 | 20.0                         | 1.079       | $(9.308)(29.17)(537)$   |
| 2.5   | 10  | 9.500                                    | 77   | 86                                     | 80                                      | 83.0                                 | 20.0                         | 1.059       | $(9.500)(29.17)(537)$   |
|   |   |  |  |  |   |                                      |                              | $Y = 1.075$ |   |

<sup>a</sup> If there is only one thermometer on the dry gas meter, record the temperature under  $t_d$  where

$V_w$  = Gas volume passing through the wet test meter,  $ft^3$   
 $V_d$  = Gas volume passing through the dry gas meter,  $ft^3$   
 $t_w$  = Temperature of the gas in the wet test meter,  $^{\circ}F$   
 $t_{d_i}$  = Temperature of the inlet gas of the dry gas meter,  $^{\circ}F$   
 $t_{d_o}$  = Temperature of the outlet gas of the dry gas meter,  $^{\circ}F$

$t_d$  = Average temperature of the gas in the dry gas meter, obtained by the average of  $t_{d_i}$  and  $t_{d_o}$ ,  $^{\circ}F$ .  
 $\Delta H$  = Pressure differential across orifice, in.  $H_2O$ .  
 $Y_i$  = Ratio of accuracy of wet test meter to dry gas meter for each run.  
 $Y$  = Average ratio of accuracy of wet test meter to dry gas meter for all three runs;  
 tolerance = pretest  $Y \pm 0.05Y$ .

$P_b$  = Barometric pressure, in. Hg.  
 $\theta$  = Time of calibration run, min.

POST Y RANGE = PICK TEST  $Y \pm 0.05 Y$   
 $= 1.0232 \rightarrow 1.1309$

## **APPENDIX Q**

### **Exhaust Gas Moisture Content and Velocity Calculations**

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## XROM "METH 5"

RUN NUMBER  
BLDG 403, BOILER 2

METER BOX Y? RUN  
1.0770 RUN

DELTA H? RUN  
2.0000 RUN

BAR PRESS ? RUN  
29.8600 RUN

METER VOL ? RUN  
27.0840 RUN

MTR TEMP F? RUN  
128.2000 RUN

% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ? RUN

STATIC HOH IN ? RUN  
-.0000 RUN

STACK TEMP. RUN  
578.9000 RUN

ML. WATER ? RUN  
100.5000 RUN

IMP. % HOH = 15.3

% HOH=15.3

% CO2?

6.9000 RUN

**% OXYGEN?** RUN  
6.9000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.42  
MW WET=27.68

SOFT PSTS ? RUN  
11.6388 RUN

TIME MIN ? RUN  
40.0000 RUN

~~██████████~~ RUN

STK DIA INCH ? RUN  
12.2500 RUN

\* VOL MTR STD = 26.260  
STK PRES ABS = 29.85  
VOL HOH GAS = 4.73  
% MOISTURE = 15.26  
MOL DRY GAS = 0.847  
% NITROGEN = 85.20  
MOL WT DRY = 29.42  
MOL WT WET = 27.68  
VELOCITY FPS = 29.58  
STACK AREA = 0.82  
STACK ACFM = 1.452.  
\* STACK DSCFM = 624.

## XROM "METH 5"

RUN NUMBER  
BLDG 403, BOILER 3

METER BOX Y? RUN  
1.0770 RUN

DELTA H? RUN  
1.9000 RUN

BAR PRESS ? RUN  
29.8600 RUN

METER VOL ? RUN  
25.8910 RUN

MTR TEMP F? RUN  
115.3000 RUN

% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ? RUN

STATIC HOH IN ? RUN  
-.0000 RUN

STACK TEMP. RUN  
502.5000 RUN

ML. WATER ? RUN  
94.2000 RUN

IMP. % HOH = 14.7

% HOH=14.7

% CO2?

8.0000 RUN

% OXYGEN? RUN  
7.2000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.57  
MW WET=27.86

SOFT PSTS ? RUN  
10.9672 RUN

TIME MIN ? RUN  
40.0000 RUN

NOZZLE DIA ? RUN  
.5000 RUN

STK DIA INCH ? RUN  
12.2500 RUN

\* VOL MTR STD = 25.660  
STK PRES ABS = 29.85  
VOL HOH GAS = 4.43  
% MOISTURE = 14.73  
MOL DRY GAS = 0.853  
% NITROGEN = 84.80  
MOL WT DRY = 29.57  
MOL WT WET = 27.86  
VELOCITY FPS = 27.31  
STACK AREA = 0.82  
STACK ACFM = 1.341.  
\* STACK DSCFM = 626.

## XROM "METH 5"

RUN NUMBER  
BLDG 403, BOILER 5

METER BOX Y? RUN  
1.0770 RUN

DELTA H? RUN  
1.4000 RUN

BAR PRESS ? RUN  
29.6050 RUN

METER VOL ? RUN  
22.9910 RUN

MTR TEMP F? RUN  
120.7000 RUN

% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ? RUN

STATIC HOH IN ? RUN  
-.0450 RUN

STACK TEMP. RUN  
333.8000 RUN

ML. WATER ? RUN  
87.4000 RUN

IMP. % HOH = 15.5

% HOH=15.54

% CO2?

8.0000 RUN

% OXYGEN? RUN  
8.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.60  
MW WET=27.80

SOFT PSTS ? RUN  
10.3136 RUN

TIME MIN ? RUN  
40.0000 RUN

~~██████████~~ RUN

STK DIA INCH ? RUN  
15.7500 RUN

\* VOL MTR STD = 22.355  
STK PRES ABS = 29.60  
VOL HOH GAS = 4.11  
% MOISTURE = 15.54  
MOL DRY GAS = 0.845  
% NITROGEN = 84.00  
MOL WT DRY = 29.60  
MOL WT WET = 27.80  
VELOCITY FPS = 25.82  
STACK AREA = 1.35  
STACK ACFM = 2.096.  
\* STACK DSCFM = 1,165.

## XROM -METH 5-

RUN NUMBER  
BLDG 611, BOILER 1

METER BOX Y? RUN  
1.0770 RUN  
DELTA H? RUN  
1.4000 RUN  
BAR PRESS ? RUN  
29.6050 RUN  
METER VOL ? RUN  
22.2980 RUN  
MTR TEMP F? RUN  
95.6000 RUN

% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ?

STATIC HOH IN ? RUN  
-.0350 RUN

STACK TEMP. RUN  
409.1000 RUN

ML. WATER ? RUN  
61.2000 RUN

IMP. % HOH = 11.3

% HOH=11.3

% CO2? RUN  
7.0000 RUN

% OXYGEN? RUN  
11.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWD =29.56  
MW WET=28.26

SQRT PSTS ? RUN  
10.2839 RUN

TIME MIN ? RUN  
40.0000 RUN

~~XXXXXXXXXX~~ RUN

STK DIA INCH ? RUN  
13.7500 RUN

\* VOL MTR STD = 22.660  
STK PRES ABS = 29.60  
VOL HOH GAS = 2.88  
% MOISTURE = 11.28  
MOL DRY GAS = 0.887  
% NITROGEN = 82.00  
MOL WT DRY = 29.56  
MOL WT WET = 28.26  
VELOCITY FPS = 25.53  
STACK AREA = 1.03  
STACK ACFM = 1,580.  
\* STACK DSCFM = 843.

## XROM -METH 5-

RUN NUMBER  
BLDG 922, HW BOILER

METER BOX Y? RUN  
1.0770 RUN  
DELTA H? RUN  
1.4000 RUN  
BAR PRESS ? RUN  
29.8150 RUN  
METER VOL ? RUN  
22.9060 RUN  
MTR TEMP F? RUN  
111.9000 RUN

% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ?

STATIC HOH IN ? RUN  
-.0050 RUN

STACK TEMP. RUN  
253.6000 RUN

ML. WATER ? RUN  
39.7000 RUN

IMP. % HOH = 7.6

% HOH=7.6

% CO2? RUN  
8.0000 RUN

% OXYGEN? RUN  
8.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWD =29.60  
MW WET=28.72

SQRT PSTS ? RUN  
1.4105 RUN

TIME MIN ? RUN  
40.0000 RUN

~~XXXXXXXXXX~~ RUN

STK DIA INCH ? RUN  
8.0000 RUN

\* VOL MTR STD = 22.774  
STK PRES ABS = 29.81  
VOL HOH GAS = 1.87  
% MOISTURE = 7.58  
MOL DRY GAS = 0.924  
% NITROGEN = 84.00  
MOL WT DRY = 29.60  
MOL WT WET = 28.72  
VELOCITY FPS = 3.46  
STACK AREA = 0.35  
STACK ACFM = 72.  
\* STACK DSCFM = 49.

## XROM -METH 5-

RUN NUMBER  
BLDG 922, BOILER 1

METER BOX Y? RUN  
1.0770 RUN  
DELTA H? RUN  
1.4000 RUN  
BAR PRESS ? RUN  
29.6350 RUN  
METER VOL ? RUN  
23.4440 RUN  
MTR TEMP F? RUN  
95.7000 RUN

% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ?

STATIC HOH IN ? RUN  
-.0200 RUN

STACK TEMP. RUN  
295.5000 RUN

ML. WATER ? RUN  
126.2000 RUN

IMP. % HOH = 19.9

% HOH=19.9

% CO2? RUN  
8.0000 RUN

% OXYGEN? RUN  
8.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWD =29.60  
MW WET=27.29

SQRT PSTS ? RUN  
4.4233 RUN

TIME MIN ? RUN  
40.0000 RUN

~~XXXXXXXXXX~~ RUN

STK DIA INCH ? RUN  
9.7500 RUN

\* VOL MTR STD = 23.845  
STK PRES ABS = 29.63  
VOL HOH GAS = 5.94  
% MOISTURE = 19.94  
MOL DRY GAS = 0.801  
% NITROGEN = 84.00  
MOL WT DRY = 29.60  
MOL WT WET = 27.29  
VELOCITY FPS = 11.17  
STACK AREA = 0.52  
STACK ACFM = 348.  
\* STACK DSCFM = 193.



XROM "METH 5"

RUN NUMBER  
BLDG 1046, BOILER 1

METER BOX Y? RUN  
1.0770 RUN

DELTA H? RUN  
1.4000 RUN

BAR PRESS ? RUN  
29.8150 RUN

METER VOL ? RUN  
22.7650 RUN

MTR TEMP F? RUN  
96.0000 RUN

% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ? RUN

STATIC HOH IN ? RUN  
-.0550 RUN

STACK TEMP. RUN  
358.0000 RUN

ML. WATER ? RUN  
71.0000 RUN

IMP. % HOH = 12.6

% HOH=12.6

% CO2? RUN  
8.0000 RUN

% OXYGEN? RUN  
8.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.60  
MW WET=28.14

SORT PSTS ? RUN  
6.1812 RUN

TIME MIN ? RUN  
40.0000 RUN

~~██████████~~ RUN

STK DIA INCH ? RUN  
15.0000 RUN

\* VOL MTR STD = 23.282  
STK PRES ABS = 29.81  
VOL HOH GAS = 3.34  
% MOISTURE = 12.55  
MOL DRY GAS = 0.874  
% NITROGEN = 84.00  
MOL WT DRY = 29.60  
MOL WT WET = 28.14  
VELOCITY FPS = 15.32  
STACK AREA = 1.23  
STACK ACFM = 1.128.  
\* STACK DSCFM = 635.

XROM "METH 5"

RUN NUMBER  
BLDG 1102, BOILER 1

METER BOX Y? RUN  
1.0770 RUN

DELTA H? RUN  
1.4000 RUN

BAR PRESS ? RUN  
29.8150 RUN

METER VOL ? RUN  
22.5760 RUN

MTR TEMP F? RUN  
87.7000 RUN

% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ? RUN

STATIC HOH IN ? RUN  
-.0400 RUN

STACK TEMP. RUN  
237.7000 RUN

ML. WATER ? RUN  
54.7000 RUN

IMP. % HOH = 9.9

% HOH=9.9

% CO2? RUN  
8.0000 RUN

% OXYGEN? RUN  
8.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.60  
MW WET=28.45

SORT PSTS ? RUN  
6.0948 RUN

TIME MIN ? RUN  
40.0000 RUN

~~██████████~~ RUN

STK DIA INCH ? RUN  
9.7500 RUN

\* VOL MTR STD = 23.430  
STK PRES ABS = 29.81  
VOL HOH GAS = 2.57  
% MOISTURE = 9.90  
MOL DRY GAS = 0.901  
% NITROGEN = 84.00  
MOL WT DRY = 29.60  
MOL WT WET = 28.45  
VELOCITY FPS = 15.03  
STACK AREA = 0.52  
STACK ACFM = 468.  
\* STACK DSCFM = 318.

155

XROM "METH 5"

RUN NUMBER  
BLDG 1130, BOILER 1

METER BOX Y? RUN  
1.0770 RUN

DELTA H? RUN  
1.4000 RUN

BAR PRESS ? RUN  
29.6350 RUN

METER VOL ? RUN  
22.6260 RUN

MTR TEMP F? RUN  
100.2000 RUN

% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ? RUN

STATIC HOH IN ? RUN  
-.1600 RUN

STACK TEMP. RUN  
407.9000 RUN

ML. WATER ? RUN  
40.1000 RUN

IMP. % HOH = 9.0

% HOH=9.0

% CO2? RUN  
7.0000 RUN

% OXYGEN? RUN  
11.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.56  
MW WET=28.52

SORT PSTS ? RUN  
11.3643 RUN

TIME MIN ? RUN  
40.0000 RUN

~~██████████~~ RUN

STK DIA INCH ? RUN  
10.0000 RUN

\* VOL MTR STD = 22.920  
STK PRES ABS = 29.62  
VOL HOH GAS = 2.26  
% MOISTURE = 9.02  
MOL DRY GAS = 0.910  
% NITROGEN = 82.00  
MOL WT DRY = 29.56  
MOL WT WET = 28.52  
VELOCITY FPS = 28.00  
STACK AREA = 0.55  
STACK ACFM = 919.  
\* STACK DSCFM = 504.

XROM "METH 5"

RUN NUMBER  
BLDG 1200, BOILER #1

METER BOX Y? RUN

1.0770 RUN

DELTA H? RUN

1.3700 RUN

BAR PRESS ? RUN

29.9450 RUN

METER VOL ? RUN

26.9280 RUN

MTR TEMP F? RUN

89.4000 RUN

% OTHER GAS

REMOVED BEFORE

DRY GAS METER ? RUN

STATIC HOH IN ? RUN

-0.450 RUN

STACK TEMP. RUN

369.1000 RUN

ML. WATER ? RUN

58.9000 RUN

IMP. % HOH = 9.0

% HOH=9.0

% CO2? RUN

6.8000 RUN

% OXYGEN? RUN

11.4000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.54

MW WET=28.50

SORT PSTS ? RUN

9.1134 RUN

TIME MIN ? RUN

48.0000 RUN

██████████ RUN

██████████ RUN

STK DIA INCH ? RUN

9.6300 RUN

\* VOL MTR STD = 27.989

STK PRES ABS = 29.94

VOL HOH GAS = 2.77

% MOISTURE = 9.01

MOL DRY GAS = 0.910

% NITROGEN = 81.80

MOL WT DRY = 29.54

MOL WT WET = 28.50

VELOCITY FPS = 22.40

STACK AREA = 0.51

STACK ACFM = 680.

\* STACK DSCFM = 394.

XROM "METH 5"

RUN NUMBER  
BLDG 1200, BOILER 2

METER BOX Y? RUN

1.0770 RUN

DELTA H? RUN

1.5700 RUN

BAR PRESS ? RUN

29.9450 RUN

METER VOL ? RUN

25.3220 RUN

MTR TEMP F? RUN

121.4000 RUN

% OTHER GAS

REMOVED BEFORE

DRY GAS METER ? RUN

STATIC HOH IN ? RUN

-0.450 RUN

STACK TEMP. RUN

266.2000 RUN

ML. WATER ? RUN

75.0000 RUN

IMP. % HOH = 12.4

% HOH=12.4

% CO2? RUN

7.0000 RUN

% OXYGEN? RUN

11.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.56

MW WET=28.12

SORT PSTS ? RUN

4.6228 RUN

TIME MIN ? RUN

48.0000 RUN

██████████ RUN

██████████ RUN

STK DIA INCH ? RUN

9.6300 RUN

\* VOL MTR STD = 24.883

STK PRES ABS = 29.94

VOL HOH GAS = 3.53

% MOISTURE = 12.42

MOL DRY GAS = 0.876

% NITROGEN = 82.00

MOL WT DRY = 29.56

MOL WT WET = 28.12

VELOCITY FPS = 11.44

STACK AREA = 0.51

STACK ACFM = 347.

\* STACK DSCFM = 221.

XROM "METH 5"

RUN NUMBER  
BLDG 1200, BOILER #3

METER BOX Y? RUN

1.0770 RUN

DELTA H? RUN

1.3000 RUN

BAR PRESS ? RUN

29.9290 RUN

METER VOL ? RUN

25.4150 RUN

MTR TEMP F? RUN

107.5000 RUN

% OTHER GAS

REMOVED BEFORE

DRY GAS METER ? RUN

STATIC HOH IN ? RUN

-0.0900 RUN

STACK TEMP. RUN

281.6000 RUN

ML. WATER ? RUN

66.3000 RUN

IMP. % HOH = 10.9

% HOH=10.9

% CO2? RUN

8.0000 RUN

% OXYGEN? RUN

8.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.60

MW WET=28.34

SORT PSTS ? RUN

8.1510 RUN

TIME MIN ? RUN

48.0000 RUN

██████████ RUN

██████████ RUN

STK DIA INCH ? RUN

9.6300 RUN

\* VOL MTR STD = 25.556

STK PRES ABS = 29.92

VOL HOH GAS = 3.12

% MOISTURE = 10.88

MOL DRY GAS = 0.891

% NITROGEN = 84.00

MOL WT DRY = 29.60

MOL WT WET = 28.34

VELOCITY FPS = 20.10

STACK AREA = 0.51

STACK ACFM = 610.

\* STACK DSCFM = 387.

XROM "METH 5"  
 RUN NUMBER  
 BLDG 1206, SMALL BOILER  
 RUN  
 METER BOX Y?  
 1.0770 RUN  
 DELTA H?  
 1.2500 RUN  
 BAR PRESS ?  
 29.8400 RUN  
 METER VOL ?  
 25.6360 RUN  
 MTR TEMP F?  
 98.2500 RUN  
 % OTHER GAS  
 REMOVED BEFORE  
 DRY GAS METER ?  
 RUN  
 STATIC HOH IN ?  
 -.0050 RUN  
 STACK TEMP.  
 238.1000 RUN  
 ML. WATER ?  
 65.4000 RUN  
 IMP. % HOH = 10.5  
 % HOH=10.5

% CO2?  
 7.0000 RUN  
 % OXYGEN?  
 11.0000 RUN  
 % CO ?  
 RUN  
 MOL WT OTHER?  
 RUN

MWd =29.56  
 MW WET=28.34

SORT PSTS ?  
 3.1900 RUN  
 TIME MIN ?  
 48.0000 RUN  
~~██████████~~ RUN  
 STK DIA INCH ?  
 13.8800 RUN

\* VOL MTR STD = 26.124  
 STK PRES ABS = 29.84  
 VOL HOH GAS = 3.08  
 % MOISTURE = 10.54  
 MOL DRY GAS = 0.295  
 % NITROGEN = 82.00  
 MOL WT DRY = 29.56  
 MOL WT WET = 28.34  
 VELOCITY FPS = 7.88  
 STACK AREA = 1.85  
 STACK ACFM = 497.  
 \* STACK DSCFM = 335.

XROM "METH 5"  
 RUN NUMBER  
 BLDG 1402, BOILER 1  
 RUN  
 METER BOX Y?  
 1.0770 RUN  
 DELTA H?  
 1.4000 RUN  
 BAR PRESS ?  
 29.8500 RUN  
 METER VOL ?  
 22.3040 RUN  
 MTR TEMP F?  
 88.9000 RUN  
 % OTHER GAS  
 REMOVED BEFORE  
 DRY GAS METER ?  
 RUN  
 STATIC HOH IN ?  
 -.0100 RUN  
 STACK TEMP.  
 255.1000 RUN  
 ML. WATER ?  
 51.6000 RUN  
 IMP. % HOH = 9.5  
 % HOH=9.5

% CO2?  
 7.0000 RUN  
 % OXYGEN?  
 11.0000 RUN  
 % CO ?  
 RUN  
 MOL WT OTHER?  
 RUN

MWd =29.56  
 MW WET=28.46

SORT PSTS ?  
 4.3536 RUN  
 TIME MIN ?  
 39.5000 RUN  
~~██████████~~ RUN  
 STK DIA INCH ?  
 10.7500 RUN

\* VOL MTR STD = 23.132  
 STK PRES ABS = 29.85  
 VOL HOH GAS = 2.43  
 % MOISTURE = 9.50  
 MOL DRY GAS = 0.905  
 % NITROGEN = 82.00  
 MOL WT DRY = 29.56  
 MOL WT WET = 28.46  
 VELOCITY FPS = 10.73  
 STACK AREA = 0.63  
 STACK ACFM = 406.  
 \* STACK DSCFM = 270.

XROM "METH 5"  
 RUN NUMBER  
 BLDG 1422, BOILER 1  
 RUN  
 METER BOX Y?  
 1.0770 RUN  
 DELTA H?  
 1.4000 RUN  
 BAR PRESS ?  
 29.8500 RUN  
 METER VOL ?  
 21.8730 RUN  
 MTR TEMP F?  
 93.9000 RUN  
 % OTHER GAS  
 REMOVED BEFORE  
 DRY GAS METER ?  
 RUN  
 STATIC HOH IN ?  
 -.0100 RUN  
 STACK TEMP.  
 241.6000 RUN  
 ML. WATER ?  
 66.8000 RUN  
 IMP. % HOH = 12.3  
 % HOH=12.3

% CO2?  
 7.0000 RUN  
 % OXYGEN?  
 11.0000 RUN  
 % CO ?  
 RUN  
 MOL WT OTHER?  
 RUN

MWd =29.56  
 MW WET=28.14

SORT PSTS ?  
 3.7343 RUN  
 TIME MIN ?  
 40.0000 RUN  
~~██████████~~ RUN  
 STK DIA INCH ?  
 17.5000 RUN

\* VOL MTR STD = 22.480  
 STK PRES ABS = 29.85  
 VOL HOH GAS = 3.14  
 % MOISTURE = 12.27  
 MOL DRY GAS = 0.877  
 % NITROGEN = 82.00  
 MOL WT DRY = 29.56  
 MOL WT WET = 28.14  
 VELOCITY FPS = 9.25  
 STACK AREA = 1.67  
 STACK ACFM = 927.  
 \* STACK DSCFM = 611.

## XROM -METH 5-

RUN NUMBER  
BLDG 1604, BOILER 1  
METER BOX Y? RUN  
1.0770 RUN  
DELTA H? RUN  
1.4000 RUN  
BAR PRESS ? RUN  
29.8060 RUN  
METER VOL ? RUN  
22.6450 RUN  
MTR TEMP F? RUN  
104.5000 RUN  
% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ? RUN  
STATIC HOH IN ? RUN  
-.0700 RUN  
STACK TEMP. RUN  
151.8000 RUN  
ML. WATER ? RUN  
57.2000 RUN  
IMP. % HOH = 10.6  
% HOH=10.6

% CO2? RUN  
7.0000 RUN  
% OXYGEN? RUN  
11.0000 RUN  
% CO ? RUN  
MOL WT OTHER? RUN

MWd =29.56  
MW WET=28.34

SORT PSTS ? RUN  
8.8416 RUN  
TIME MIN ? RUN  
40.0000 RUN  
██████████ RUN  
██████████ RUN  
STK DIA INCH ? RUN  
7.5000 RUN

\* VOL MTR STD = 22.803  
STK PRES ABS = 29.80  
VOL HOH GAS = 2.69  
% MOISTURE = 10.56  
MOL DRY GAS = 0.894  
% NITROGEN = 82.00  
MOL WT DRY = 29.56  
MOL WT WET = 28.34  
VELOCITY FPS = 21.85  
STACK AREA = 0.31  
STACK ACFM = 402.  
\* STACK DSCFM = 309.

## XROM -METH 5-

RUN NUMBER  
BLDG 1614, BOILER 2  
METER BOX Y? RUN  
1.0770 RUN  
DELTA H? RUN  
1.4000 RUN  
BAR PRESS ? RUN  
29.8060 RUN  
METER VOL ? RUN  
22.8700 RUN  
MTR TEMP F? RUN  
88.6000 RUN  
% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ? RUN  
STATIC HOH IN ? RUN  
-.0100 RUN  
STACK TEMP. RUN  
260.3000 RUN  
ML. WATER ? RUN  
52.3000 RUN  
IMP. % HOH = 9.4  
% HOH=9.4

% CO2? RUN  
7.0000 RUN  
% OXYGEN? RUN  
11.0000 RUN  
% CO ? RUN  
MOL WT OTHER? RUN

MWd =29.56  
MW WET=28.47

SORT PSTS ? RUN  
4.8660 RUN  
TIME MIN ? RUN  
40.0000 RUN  
██████████ RUN  
██████████ RUN  
STK DIA INCH ? RUN  
16.0000 RUN

\* VOL MTR STD = 23.697  
STK PRES ABS = 29.81  
VOL HOH GAS = 2.46  
% MOISTURE = 9.41  
MOL DRY GAS = 0.906  
% NITROGEN = 82.00  
MOL WT DRY = 29.56  
MOL WT WET = 28.47  
VELOCITY FPS = 12.00  
STACK AREA = 1.40  
STACK ACFM = 1.005.  
\* STACK DSCFM = 665.

## XROM -METH 5-

RUN NUMBER  
BLDG 1604, BOILER 1  
METER BOX Y? RUN  
1.0770 RUN  
DELTA H? RUN  
1.4000 RUN  
BAR PRESS ? RUN  
29.8060 RUN  
METER VOL ? RUN  
22.7500 RUN  
MTR TEMP F? RUN  
107.6000 RUN  
% OTHER GAS  
REMOVED BEFORE  
DRY GAS METER ? RUN  
STATIC HOH IN ? RUN  
-.0100 RUN  
STACK TEMP. RUN  
272.5000 RUN  
ML. WATER ? RUN  
57.7000 RUN  
IMP. % HOH = 10.6  
% HOH=10.6

% CO2? RUN  
7.0000 RUN  
% OXYGEN? RUN  
11.0000 RUN  
% CO ? RUN  
MOL WT OTHER? RUN

MWd =29.56  
MW WET=28.33

SORT PSTS ? RUN  
4.6759 RUN  
TIME MIN ? RUN  
40.0000 RUN  
██████████ RUN  
██████████ RUN  
STK DIA INCH ? RUN  
16.0000 RUN

\* VOL MTR STD = 22.792  
STK PRES ABS = 29.81  
VOL HOH GAS = 2.72  
% MOISTURE = 10.65  
MOL DRY GAS = 0.894  
% NITROGEN = 82.00  
MOL WT DRY = 29.56  
MOL WT WET = 28.33  
VELOCITY FPS = 11.56  
STACK AREA = 1.40  
STACK ACFM = 968.  
\* STACK DSCFM = 621.

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